

# Electrical Contracting

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Electrict and Electrical Record  
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EARL WHITEHORNE  
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GLENN SUTTON  
Manager

FRANK J. SEILER Associate Editor  
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W. T. STUART Middle West Editor  
W. A. CYR Pacific Coast Editor  
HARRY PHILLIPS Art Director

A SERVICE PAPER for electrical contractors, engineers, motor shops, industrial electricians and inspectors, covering engineering, installation, repairing, maintenance and management, in the field of electrical construction — industrial, commercial, residential.

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APRIL, 1938

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JAMES H. McGRAW, JR.  
President

B. R. PUTNAM  
Treasurer

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Executive Vice-President

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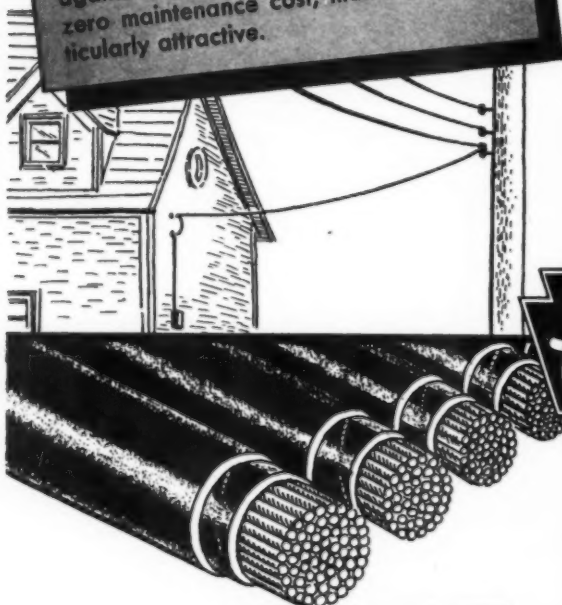
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# HAZARD PRODUCTS

FOR THE *Electrical Contracting Industry*

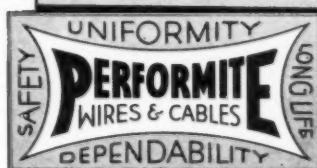
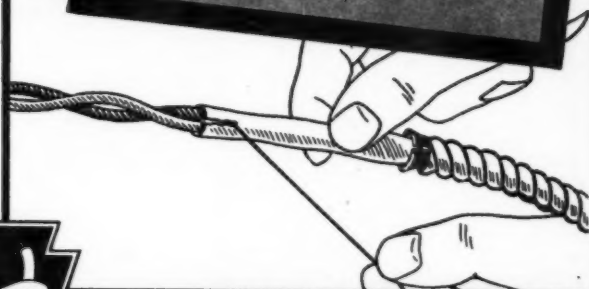
## HAZARD SERVICE ENTRANCE CABLES

type SE with bare neutral conductor are adapted to the new sequence arrangement of meter, switch and fuse. Their low cost, ease of installation, insurance against current diversion and practically zero maintenance cost, make them particularly attractive.



## HAZARD ARMORED CABLES, Type AC

have a flame-resisting, moisture-proof paper sheath between the conductors and spiral interlocked steel armor. A ripcord beneath the paper facilitates installation. An insulating bushing is inserted at the cut ends over the paper sheath.



## HAZARD PERMEX

thin-wall rubber insulation provides a means of constructing cables containing a maximum number of separately insulated conductors with minimum diameter and weight. It is used for multi-conductor telephone cables, supervisory control, fire alarm, police signal, etc.

## PERFORMITE INSULATION

is a higher type of rubber insulation which affords longer life and greater safety. Performite rubber insulation is tougher and stronger than any in common use heretofore, and has greater life. It is made with "Safecote" weatherproof and flame-retarding finish.

# HAZARD INSULATED WIRE WORKS

DIVISION OF  
WILKES-BARRE



THE OKONITE CO.  
PENNSYLVANIA

APRIL, 1938

## "Mama Love Papa?"

GOD HELP MY GRAND CHILDREN—and their brats! When I think about the conditions they'll be up against, I break right down and weep. Life is getting too complicated. Look at the motor business.

TIME WAS WHEN ALL A MOTOR HAD TO DO was run a belt. Machines were simple. But today they are as temperamental as Greta Garbo. And you pick your motor like a gal selects a lipstick.

ONCE THE MAN WHO SOLD MOTORS SAID—"Here they are! You ought to use 'em!" Today some one must go into each factory, understand its processes and purposes and fit the 57 varieties of the modern motor to the highly specialized machinery, now so different in every plant. It has become a hand tailoring job.

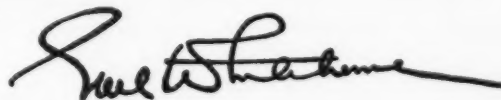
THAT'S WHY WE HAVE THOUSANDS of motor service shops across the country. And just as the manufacturer knows his motors, these service shops know the local factories and what they need—and why. It is a vital service—tailors to home town machines.

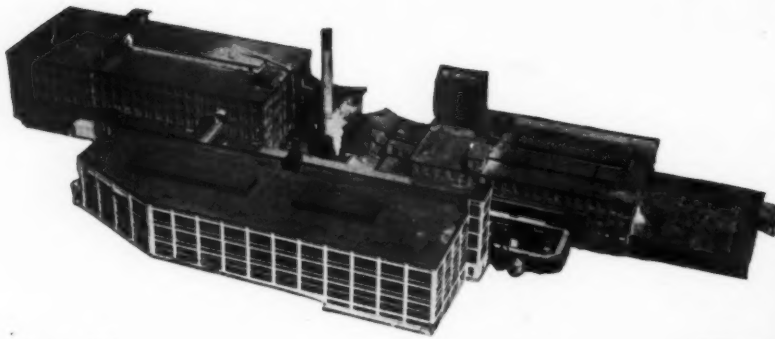
BUT THE MOTOR MANUFACTURERS AND THESE SHOPS DON'T ALWAYS PULL TOGETHER. You would think it would be a case of "Mama loves papa." But it seems more like a blond and a mother-in-law. The shops say motor resale discounts are too low. So they sell rebuilt machines and make more profit. So the manufacturers sell the big buyers direct. Ho-hum!

IT SOUNDS BAD. But it needn't be. A recent check-up showed that 92 motor shops averaged 208 new motors, sold during the year before to 159 industrial customers. I know shops that sell \$50,000 a year in new motors—and better. And the volume of new motor sales through motor shops by some manufacturers is very substantial.

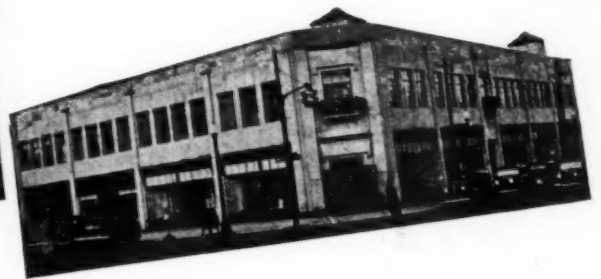
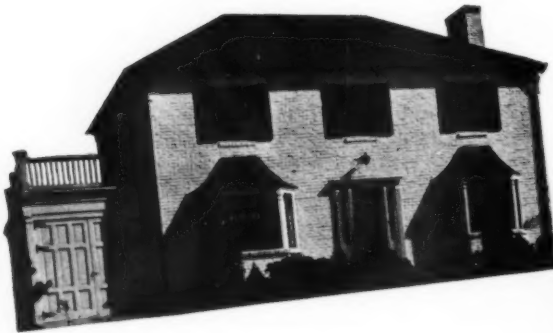
THINK WHAT WOULD HAPPEN if these two groups would really team up with an enthusiastic profitable cooperation! The manufacturer could build up the motor shop as its local hand tailored service to modern machinery. He could save enough on his own sales and distribution to give the shop a discount that would make new motors pay. And the shop could pass on its intimate application knowledge to the motor manufacturer and do a creative local job of selling and servicing his line.

IT'S ABOUT TIME THE FAMILY HAD A FOND REUNION. It would be nice if NISA pulled the party. (Pardon the pun!)





# Your job ?



Today . . . some Electrical Contractors specialize in residence wiring and repairs. Others have built up an industrial business. Still others, in large cities, do almost nothing but commercial buildings.

Yet . . . regardless of what type of work you do . . . Graybar can serve you *completely*. Because Graybar's 60,000 electrical items meet

every electrical need. Because Graybar has grown up with the electrical industry from the beginning and knows what those needs are.

Furthermore, a well-stocked Graybar warehouse near you makes its products quickly and conveniently available. (Counter Service for quick pick-ups! . . . Or use your telephone for prompt delivery). Try Graybar, for everything!

**Everything electrical for all  
types of Contracting**



# GraybaR



OFFICES IN 85 PRINCIPAL CITIES • EXECUTIVE OFFICES: GRAYBAR BUILDING, NEW YORK, N. Y.



**SALES MANPOWER** must cover a wide industrial service field. Here is the staff of Buzzell Electric Works in San Francisco.



**MOTOR SPECIALISTS** present new ideas to prospects and arouse interest. This Chicago dealer opens factory doors to sales effort.

**A**NY reliable service shop is qualified to render at least four important services to industry: 1—Repair and maintenance, 2—Motor application and sales, 3—Control and distribution equipment sales, 4—Sales of motor drives and supplies. But for success, these several functions must go hand in hand and be in balance. This requires both sales initiative and sales control.

Naturally opinion differs as to how this can be done most effectively. Only experience gives sound guidance. With this in mind, a number of motor specialists in various cities have expressed their views as applied to the service shop's position in the business of selling and servicing motors.

The points of chief concern to motor shop operators, as reported, are—

- A—Finding the best motor prospects.
- B—Engineering and application functions.
- C—Promoting service shop sales.
- D—Successful trade-in policies.

#### **Finding the Best Motor Prospects**

The service shop's field of activity, spreads across the roster of industries as well as general business and the institutions of its logical trade area. This list will vary, of course, according to the prevailing types of local activity. When one industry predominates in a community, the motor market naturally centers on these applications of power, and the motor shops become specialized in this work. In some large communities a shop will specialize to some extent in several industries. The diversity of prospects available emphasizes the importance of selecting them from within the most promising industries.

## **Selling MOTOR SHOP Service**

### **An experience check-up on the four major problems of the motor service shop**

The contacting and classifying of sales possibilities within an area is a big job. But it is worth the man-power and proper promotional effort it entails. Some examples of such sales activity follow—

**1.** One eastern motor dealer travels 30 miles in all directions from his city. They look for heavy service lines to buildings as indicating motor loads. Plant engineers and electricians seem to be the best persons to contact. Leads for motor sales are turned in by service men who go out on trouble calls.

**2.** Another eastern service shop reports 40 per cent of its 1937 volume derived from motor and equipment sales. Their system is to sell the mechanical staff of selected prospects and then work up through the purchasing agents to the top executives. This steady contact has increased service and wiring orders. They find that outside

calls produce gross profits greater than the average daily output of a shop mechanic, and do not interfere with production nor require additional shop equipment.

**3.** A middle western shop checks building reports and real estate news of factory space. If an out-of-town concern is moving in, letters are sent to the proper executives, offering assistance on power problems. When plant additions or alterations involve changes in machinery and motors, the field staff sees these new prospects through.

**4.** In the south, a shop has secured prospects by keeping in friendly contact with the power company's industrial engineers, manufacturers' sales engineers and various wholesale salesmen. Helping them work out knotty problems has paid handsome dividends in leads on new accounts.

**5.** Another shop on the Pacific Coast watches reports of fires, explosions and accidents in factories and institutions. Many good leads are developed in the early stages where quick replacement or emergency repairs are needed.



MOTORS FOR INDUSTRY involve a diversity of types and sizes. Display space at the Quality Electric Co. Ltd., Los Angeles.

SERVICE COUNTERS are the nerve center of industrial troubles. At Venino Bros. & Co. Inc. in Newark, N. J., a selected stock is displayed for drop-in trade.

EXPERIENCED ENGINEERS put service shop sales effort on a high plane of personalized engineering and application. Lewis Electric Co., Grand Rapids, Mich.



6. A middle west shop keeps in touch with machinery concerns, such as sell bakeries, laundries, conveyors, pumps and lathes. While these companies are looked upon as competitors this shop has made them cooperators.

#### Engineering and Application Functions

Engineering and application service is basic to motor sales. One midwestern shop claims that it plays a part in at least 80 per cent of its business. Interesting motor prospects often requires an initial bit of counsel or investigation, and sales engineers must make a good first impression. They must recognize the customer's needs, sense inefficient conditions and give a ready answer to problems in motor use, maintenance, control, transmission devices, energy rates.

7. An eastern firm, in business for 42 years, finds that people seldom know what they want. The shop has become one of the largest industrial service organizations in the state by following a

policy of first finding out every detail of each motor application. They sell the correct principles of application and this company's customers are ready to pay for quality equipment and service.

8. A company in the middle west has given friendly support to industrial engineers of large plants. They exchange experience and work out tough jobs together. When important orders are at stake, this shop's recommendations are respected.

9. One of the large southern service organizations finds its engineering force invaluable in coordinating details of customer equipment with installation work. When changes are contemplated in motor equipment these men are able to work out recommendations as to transformer stations, feeder layouts and power factor correction, with all responsibility resting with one firm.

10. A Pacific Coast company has three engineers in the field supervising surveys, tests on machines and other

technical matters as a part of sales routine. Their reports of transformer conditions, power factor, motor or controller performance provide the customer an impartial survey.

Summing up, the service shop gives the customer these plus values—

A. Familiarity with maintenance conditions in various industries.

B. Ability to recommend correct types of motor enclosures, windings, bearings, operating characteristics.

C. Knowledge of control equipment, ability to coordinate motors and control for proper maintenance and safety.

D. Double check on special conditions of a highly technical nature, where the manufacturer makes recommendations.

E. Complete motorization, applying speed reducers, short center drives and other transmission devices.

F. Prompt information about power and distribution problems through power analyses with instruments.

#### Promoting Service Shop Sales

As in any other business, customers must be shown what they gain by dealing with a service shop. They must be constantly reminded of the value of quality equipment and dependable maintenance. So the shop must promote its services, sell its wares and keep the company's name alive with those who place orders.

First and foremost in approaching any sales discussion comes the prime consideration of customer benefits. Here are the principal advantages cited by motor specialists—

A. Motors are furnished for correct voltage, phase and frequency.

B. Control and drives coordinated.

*Electrical Contracting, April 1938*

C. Prompt delivery of standard items from stock.

D. Temporary motors available for use while awaiting delivery on special machines.

E. Correct installation and break-in to avoid abuses to equipment.

F. Practical checkups to avoid misapplication of motors.

G. Quick replacement service and correction of motor trouble without red tape.

H. Fair trade-in allowances on equipment replaced by new motors.

It calls for steady promotion to make these points interesting and to keep them alive. It must be done by various forms of advertising—plus constant customer contact by the boss and his sales engineers. Various forms of advertising are employed such as telephone directories, newspapers, calendars, blotters, stuffers, descriptive booklets, personal letters, mail campaigns, equipment catalogs or stock lists, monthly or quarterly house organs, trade magazine listings, radio programs, sign posters, souvenirs, name plates and decalcomania, employee uniforms, truck signs and lettering.

Here are current examples of publicity methods used by various shop operators—

11. In the middle west a large concern has found newspaper ads describing specific equipment helpful. For general mailing it uses pocket size catalogs of rebuilt stock items, and also distributes scratch pads and calendars with good results.

12. A Pacific Coast shop sends out six small booklets each year, containing illustrated comment on its various departments, and reviews of outstanding repairs or installations made for prominent concerns. It sells the shop and its service the year round and backs up the

field staff's work in a dignified manner.

13. Another Pacific Coast concern sends out monthly stuffers, Christmas cards and other mail matter.

14. A southern shop took advantage of expanded facilities to prepare a handsome booklet picturing its new departments, supplemented by useful electrical tables and maintenance hints.

15. One eastern shop presents its leading customers with a handsome leather-bound daily desk calendar with gold lettering, gives key containers and pocket diaries to plant men, and handsome wall calendars for general distribution.

16. Another eastern concern hands out cigars which have a gold-lettered company ad on the cellophane wrapper.

#### Trade-in Policies

Service shops that do business with customers of all sizes cannot escape a certain number of trade-ins. And when credits are made with good judgment the motor service specialist commands a distinct and profitable sales advantage. In some shops about 70 per cent of new motor sales involve allowances for old apparatus. Of course, many shops run less. But in most cases there is some advantage in making modernization sales on the basis of trade-ins. Here are some of the reasons why it brings business—

A. Motors become unsuited after plant changeovers from d.c. to a.c., or from 25 to 60 cycles.

B. Obsolete types are not wanted in modernized plant.

C. Motors replaced by more correctly applied types are no longer needed.

D. Customers are often unwilling to carry an investment in idle off-size motors.

E. Rewinding certain types for new current supply becomes too expensive.

F. Changed processes make owner's motors unsuited to future needs.

So when service shops take in old motors, they are valued either as junk, for parts salvage, as spare or emergency motors, for rental service, for re-sale to other dealers, or for re-sale as guaranteed re-built motors. Here is the way some of the shops are handling it.

17. One eastern shop quotes two ways on repair jobs that run above 50 per cent of new motor costs. One quotation covers repairs, the other a new or rebuilt motor in exchange.

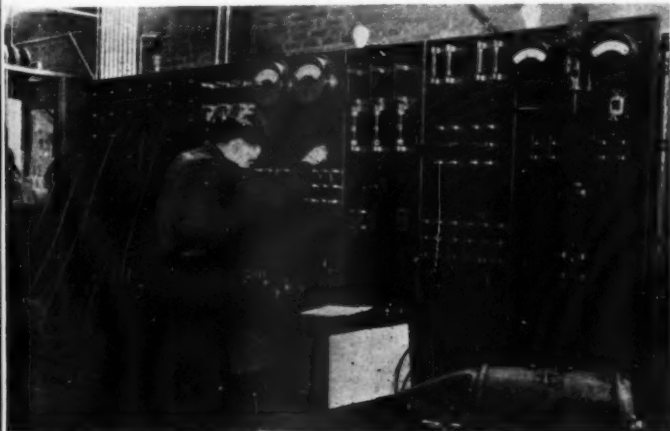
18. A middle west concern has kept in step with rapid expansion of small motor applications in the home and store. Over-the-counter transient business often involves a swap.

19. Another midwestern shop sells the replacement idea by focussing attention upon the advantages of new motor designs and applications, group drive inefficiencies and abusive plant conditions. This arouses interest in splash-proof, totally-enclosed and explosion-proof motors to replace the old.

The reputable service shop can sell new motors more easily when financially able to make trades. Reselling those taken in depends upon local reputation and guarantees. If proper care is exercised in such transactions, the turnover of reconditioned items will augment the effort applied in creating new business. When new motor sales won't go over, the order can still be saved by having high class rebuilt items available.

ENGINEERING FUNCTIONS of service shops makes their service a plus customer value. Here a testing engineer is getting the facts at the Electrical Installation Co., Cambridge, Mass.

MODERNIZATION LAGS as industry obsolescence continues. New motor stocks as in this New Jersey shop will move for dealers when good prospecting and selling-methods are put to work in this community.



# FINDING THE

# Answers

**Y**EAR by year the use of instruments increases in the motor shop. They are needed constantly in cracking hard motor sales problems. They are needed in promptly locating trouble in customers' equipment. And so these instruments have become most important factors in building business and profits.

So the reliability, efficiency and reputation of a motor shop today—and its ability to make money—depends in no small measure on its testing and measuring equipment. And if you want to prosper you must be ready with the right instruments, as well as the necessary skill, for—

1. Checking individual motors for load conditions and duty cycles, speed, power factor and controller functions.
2. Determining feeder loads, duration of peak loads, demand, reasons for excessive heating and service interruptions.
3. Locating excessive friction losses, abusive operations, checking new processes of departmental or production costs.
4. Reports on service and transformer station capacities, and power factor.
5. Surveys of isolated plant loads for changing over to purchased power operation.
6. Reports on the performance of individual machines and group drives.
7. Voltage and insulation resistance surveys on feeders, sub-feeders and circuits.
8. Checking up on plant illumination.

**THEREFORE—**

**See that You Have Adequate Equipment for Shop Testing**



The modern motor service shop needs panel type ammeters, voltmeters and wattmeters, both a.c. and d.c., installed at test benches and at the main testing switchboard, ready for—

1. Insulation tests.
2. High potential tests.
3. Short circuit and ground tests in stator and armature windings.
4. Direct current field tests.
5. Resistance tests.
6. Performance and brake tests.
7. Starting switch tests.
8. Torque tests.
9. Locked-rotor tests.
10. Efficiency tests.
11. Phase balance and current characteristics.
12. Heat runs.

SHOP CHECKUP of insulation resistance. A new stator winding is being "meggered" before final impregnation.

# IN MOTOR SERVICE

## AND ALSO—

Be Sure You Can Make Accurate  
and Intelligent Plant Surveys

Expert analysis of plant conditions is as important to motor shop customers as good workmanship in repairs. For this service, the following portable instruments should be available—

1. *Graphic Voltmeter*—For voltage surveys in plants to check complaints, trouble with motor starting, controller operations, lighting efficiency, feeder conditions.

2. *Graphic Wattmeter*—For plant surveys when changing from engine drives to purchased power; check-ups on individual motors at machines and lineshaft drives; to determine starting cycles, duration of peak loads, feeder overloads, friction loads; and for similar problems requiring a complete load record for a week or more.

3. *Graphic Power Factor Meter*—For checking heat load conditions on transformer banks, feeders and in departments, to determine corrective procedure. Lightly loaded motors can be checked for replacement with correct size to improve power factor.

4. *Power Analyzers*—Compact case assemblies of a.c. and d.c. instruments for checking feeders and motors. They have a wide range of applications in the shop and in plants.

5. *Split Core Ammeters*—Use during checkups made in connection with the sale of replacement motors, wiring modernization and to investigate complaints. Several sizes of instruments are used, equipped with interchangeable elements to read up to 600 amps. The ammeter is clamped around insulated motor leads or feeder cables, permitting quick tests without removing cable connections.



CARE OF INSTRUMENTS—Davidson Electric Company in Brooklyn keeps its graphic and indicating meters this way. They're always ready.

6. *Portable Ammeters, Voltmeters, Wattmeters, Demand Meters, Frequency Meters*—For general testing and plant surveys.

7. *Megohmmeters*—For obtaining direct measurements of insulation resistance on insulated electrical apparatus and distributing systems.

8. *Ohmmeters*—For checking resistance values in control apparatus and miscellaneous equipment.

9. *Milli-voltmeter*—For checking armatures for shorts and for coils that have been cut out.

10. *Tachometer*—Used in the sale and application of drives and motors for blowers, compressors, line shafts and other equipment. Here correct speed data are necessary before power problems can be properly handled.

11. *Thermometers*—Used to check temperature rise of motors and transformers. Especially useful when complaints arise over the performance of re-built equipment.

Such instruments are of dollar saving value also when customers complain of work done, as occurs sometimes with every shop. Test records bear witness to the condition of the machine, when it was delivered. New tests give a clear picture of the conditions causing the complaint. The case now rests on facts, not opinions, and that maintains customer confidence and holds accounts.

# Modern

**T**HE testing of repaired and rebuilt apparatus in an electrical repair shop has always been and probably always will be a problem. This is due to the wide variety of apparatus encountered—direct current motors and generators, transformers, motor generator sets, arc welders, rectifiers, convertors, induction motors, synchronous motors, resistance welders, and associated control apparatus all come in with ailments to be cured.

As a matter of fact, during the past ten years, types of apparatus have been multiplied many times over by the increasing density of electrical modifications available.

A squirrel cage induction motor used to be just that but today it might be normal starting torque, normal starting current; normal torque, low starting current; high starting torque, low starting current; or high slip. And, these characteristics are available in single speed, two speed, three speed or four speed motors which might be constant horsepower, constant torque or variable torque. Then without getting into special motors any of the above types can be continuous duty, intermittent duty, or quiet operating. Thus, while once upon

**MOTORS** have taken on a wide variety of characteristics in recent years. Close fitting of motors to loads demands that repaired motors equal their original characteristics. Accurate testing is essential. Roy Spaulding tells us how precision factory methods have been applied to meet the needs of a modern motor repair shop.

a time if the shaft went around the test was completed, today it is essential to know what the shaft will do from the time it starts to turn until it reaches full speed, and what current and power were required in the interim.

To handle this large variety of apparatus, we found it necessary to set up a separate department to do nothing but the testing and inspecting of both incoming and outgoing jobs. It is equipped to make tests quickly and accurately.

## Equipment

The main testing unit consists of a 50 hp. 1200 r.p.m., 220 volt, 3 phase, 80 per cent p.f. synchronous motor in the center, direct connected to an alternator

**By Roy C. Spaulding**

*Spaulding Electric Co., Detroit, Mich.*

on one end and a d.c. generator on the other end. The d.c. machine is a 50 kw., 250 volts, 200 amp., compound wound commutating pole generator. The alternator is a 100 k.v.a., 1200 r.p.m., 60 cycle generator, that has a well distributed winding giving a very good wave form and having a low synchronous impedance. The former is a very essential characteristic when testing capacitors or transformers and the latter is essential for the testing of large polyphase motors. All of the machines are separately excited from motor generator sets and the fields of the m.g. sets are controlled by rheostats, two in series per machine. One rheostat has a high enough resistance to prevent the generator from building up at all. The other has a low enough resistance to provide very close voltage regulation.

The main testing panel is equipped with ground test facilities, plug switches for connecting alternator output to the buss through any of five sets of current transformers with ratios from 2/1 to 250/1. There are also receptacles for wattmeter, potential coils, voltage test on single or unbalanced three phase loads, and d.c. readings.

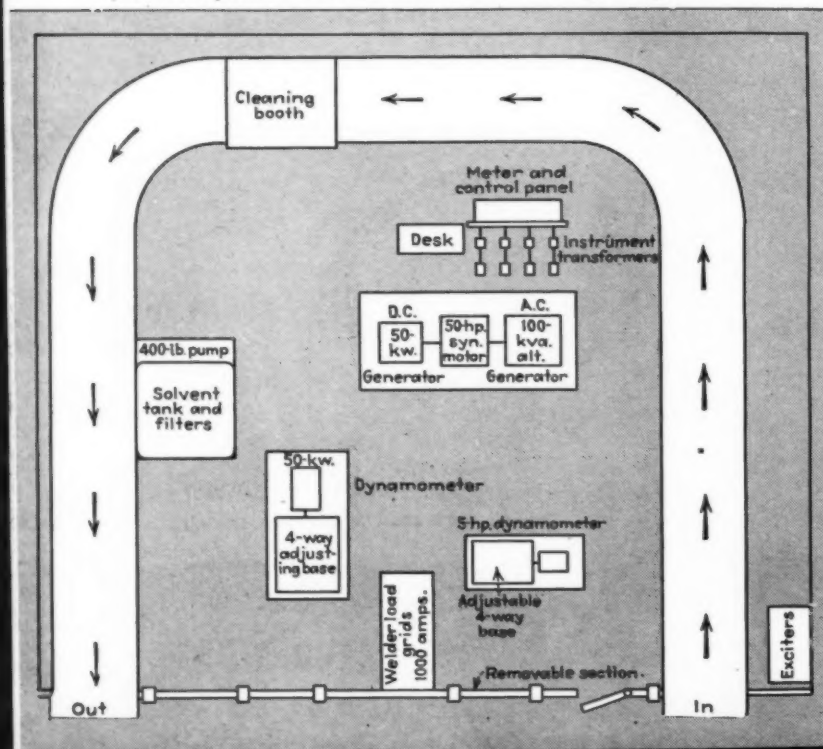
A felt-padded shelf below the panel holds a group of precision instruments, d.c. voltmeter, d.c. ammeter, polyphase wattmeter, a.c./d.c. ammeter and a.c./d.c. voltmeter. These instruments are all precision type and are periodically checked in the laboratory. They are also used as standards to check the portable instruments carried by the service men.

## Testing

All incoming or outgoing jobs are first given a ground test. For incoming machines the testing transformer circuit is so arranged that when the button is pressed, if the meter does not come up to 500 volts it is an indication that the insulation resistance is less than two megohms, and it is unsafe to apply a higher voltage. Thus no windings are punctured that might be saved by a good cleaning.

For outgoing jobs we multiply by 1.2 the test voltages prescribed by NEMA for new apparatus. This gives us a 20 per cent margin of safety over the

TEST EQUIPMENT is surrounded on three sides by a gravity roll conveyor and enclosed on the fourth side by heavy screen panels. Trap doors in the shop floor above permits a 2-ton electric hoist to handle large transformers.



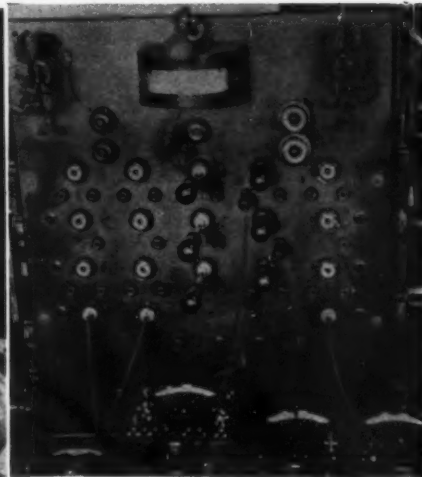
# MOTOR TEST METHODS



**ROTORS** are "buzz" tested for open bars. All testing is handled in a special department separated from the repair shop. Thus the quality of outgoing work is independently controlled. It is all important in modern service shop practice.



**TORQUE ARM** Dynamometer of 50 kw capacity and a 5 kw machine are indispensable for taking speed-torque curves on double squirrel cage induction motors, setting brush position on non-commutating pole D.C. machines and compounding D.C. generators.



**TEST PANEL** includes a 0-3000 volt a.c. voltmeter for "Hypot" or ground tests on all apparatus 440 volts or less. Voltage is controlled by a variable air gap series reactance. The contactor handles the field circuits of the alternator and D.C. generator.

ground test that is often given a motor in some of the larger automobile plants before putting it into service. All apparatus that could be used on higher voltage by reconnection is ground tested for that voltage regardless of the voltage it is connected for at the time of test. Following are final test procedures:

## Induction Motors

The d.c. resistance per phase is measured by passing 100 or more amps. through the winding and measuring the volts or multi-volts drop across the machine terminals. The motor is then connected to the testing bus through flexible leads, a convenient current transformer ratio is chosen, the plug switches is inserted, and the ammeter and wattmeter are plugged in. With the motor shaft locked (if necessary) field current is gradually applied to the alternator, until the motor is taking about twice full load current and the volts, amps, watts, and current transformer ratio are recorded. The shaft is freed and the alternator excitation is increased, until the motor is running on full rated voltage when the volts, amps, watts, and current transformer ratios are again recorded.

From this recorded data, it is possible to determine all of the motor characteristics, unless the rotor has a double squirrel cage winding. The data can be plotted into a "circle diagram" and char-

acteristics scaled or the desired information can be derived mathematically. In by far the majority of cases, we do not actually determine the characteristics. We merely require that for a given type and rating the test results fall within well defined and easily determined limits and thus the operating characteristics are ascertained to be within NEMA requirements. If the machine does not come up to requirements, the instrument readings usually tell an experienced operator where the trouble is without much mental gymnastics. Only perhaps once or twice a month we have to get out the slide rule to see what is wrong.

## Direct Current Motors—

D.c. armatures are ground tested and given a bar-to-bar test with a millivoltmeter before assembly. Fields are ground tested and ground test voltage is applied between shunt and series fields. Fields are all drop tested and checked for relative polarity.

After assembly, the field is connected to a small m.g. set having rheostats under the instrument shelf and the armature is connected to a 50/0/50 millivoltmeter and a small voltage is applied to the field. The field circuit is then broken and made and the brushes shifted until the millivoltmeter shows the minimum deflection indicating exact neutral. The millivoltmeter is disconnected and the armature connected to

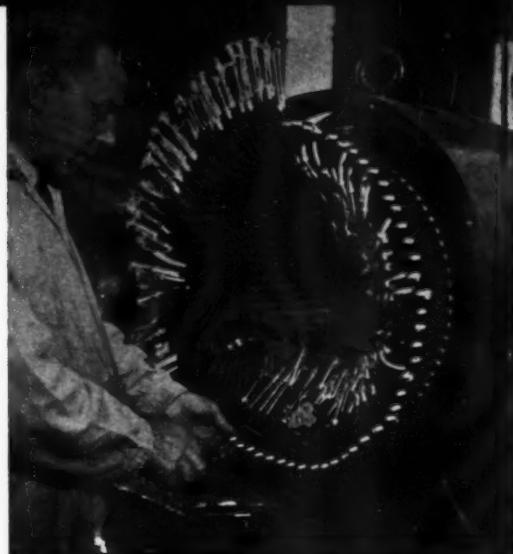
(Continued on page 80)



**POWER TRANSFORMERS** are handled in exactly the same way as induction motors. Tests are conducted to determine resistance, excitation and impedance. In addition, tests are made for voltage ratio and polarity.

# HOW ELECTRIC SERVICE SHOPS FUNCTION

Motor shops service the full scope of electrical utilization and control equipment, in all classes of business and industry. This chart lists the functions of an average shop, the materials, supplies and parts that must be kept available, and the types of shop equipment in use.



SHOP OPERATIONS	SHOP MATERIALS AND PARTS	SHOP EQUIPMENT
1. Cleaning and stripping motors and transformers	Cleaning solvents — Sand blast supplies	Burning hoods and ovens — Cleaning vats — Pressure systems for solvents and sand blast — Brushing racks — Air compressor — Stripping winch — Air cutting tools — Scrap baler
2. Coil production and installation	Magnet wire — Insulated motor leads. Tapes — Sleeving — Tubing — Insulating mica, paper and cloths — Wedges — Cordage, Banding wire — Soldering materials — Cement — Paints and lacquer, compounds — Asbestos products	Loop winding heads and machines — Wire payout racks and tension devices — Coil spreaders, tapers, clamps and stripping machines — Banding devices — Insulation racks — Cutters — Formers — Shears — Soldering and brazing devices — Stands, benches and racks
3. Commutator repairs — Brush service	Commutators — Mica — Cement — Enamel — Carbon stock — Leads — Wire — Lugs — Springs — Inserts	Dollies and stands — Undercutting and grinding attachments — Shipping and handling skids — Brush making outfit
4. Impregnation and baking	Varnish — Solvents — Enamel	Varnish drums — Vats and pressure systems — Coil racks and drip ledges — Ovens — Roll-in trucks — Temperature control devices
5. Electric machine work — Bearings — Rotor repairs — Slip ring repairs — Shafts & couplings — Assembly machinery — Weld broken parts — Build slide rails and brackets — General machine work	Bearing metal — Sleeve, roller and ball bearings — Oil rings — Wicks — Packings — Plugs — Springs — Shafting — Stock bars and rods — Key stock — Couplings and sheaves — Welding rod and supplies — Gaskets — Compounds — Tool steel — Gear stock — Machinists supplies	Babbit ladles, furnaces and forge — Grinder and buffer — Lathes — Drill presses — Milling machine — Shaper — Band saw — Power saw — Welding — Pulley pullers & jacks — Arbor press — Heavy duty hydraulic presses — Hoists, floor cranes and booms — Travelling cranes — Monorail systems — General shop tools
6. Assembling and testing — Insulation — Phase balance — Resistance — Rotor balance — Torque — Locked rotor — Noise & vibration — Temperature — Efficiency — Power factor — Voltage surveys	Bolts, springs, washers — Contacts — Terminals — Centrifugal switches — Enamel and lacquers — Oil and grease —	Spray gun and booth — Turntable benches — Floor skids and dollies — Dynamometer — Friction test brake — Balancing stands — Test switchboard — Megohmmeters — Growlers — Wheatstone bridge — Indicating and graphic meters and meter accessories — Tachometer — Pyrometer — Hoists and monorails — Delivery trucks
7. Control equipment — Repairs and re-building	Coils, contacts, resistors — Panel materials — Mica — Asbestos — Instruments — Circuit breakers — Cement — Compound — Oils — Lugs and terminals	Bench testing tools — Measuring instruments
8. Special services — Appliance repairs — Small motor dept. — Service depot for special tools and equipment	Appliance repair parts — Small motor bearings — Brushes — Switches — Spare armatures, coils, etc. — Special parts stocks for each line being serviced	Special bench, test board and parts storage — Small lathe — Drill press — Test board — Cleaning rack — Bench layout and stock bins for department
9. Equipment sales and rental — Motors, generators, m-g sets and synchronous converters — Dynamometers, turbo and engine generators — Welding generators, and frequency changers — Bench grinders — Motorized tools and drills — Blowers and exhaust fans — Transformers — Hoists —		Pumps — Speed changers — Gear reducers — Meters — Switchboards — Panels — Relays — Grids — Resistance units — Pulleys — Gears — Pinions — Rheostats — Motor starters — Switches — Bases and rails — Compensators — Controllers — Oil circuit breakers — Chain and belt drives
10. Repair parts and supplies — Bearings — Brushes — Centrifugal switches — Fuses — Compensator parts — Contacts — Brush holders — Short-circuiting devices — Belts, chains & sprockets — Lighting equipment — Fan parts — Magnet wire —		Magnet & relay coils — Varnish — Compounds — Tapes — Insulating papers — Mica — Fibre — Copper lugs and bars — General wiring supplies

# SERVICE SHOP EQUIPMENT

Check List of Principal Equipment Required for Motor Service Shops

SHOP OPERATION	SMALL SHOP — UP TO 10 HP.	MEDIUM SHOP — UP TO 200 HP.	LARGE SHOP — UP TO 1000 HP.
1. Coil Burning	Local burning gas or rags	Booth & torch flame	Booth & torch flame or power leads
2. Stripping	Hand tools	Winch	Air gun — Cutting winch-pulling
3. Cleaning	Brushing stand and vat-air compressor	Solvent vat-pressure gun & booth-air compressor	Solvent spray system — Immersion vats — Air compressor
4. Winding	Comb. group and hair-pin	Light winder & group head — Heavy duty winder	Three or more sizes with changeable heads
5. Wire tension	3-wire	6-wire	6-, 9- and 12-wire
6. Coil spreading	Small bench model	30-in. floor type	30-in. floor type 60-in. floor type
7. Taping	Hand	Motorized bench type	2 or more bench type
8. Insulation forming	Hand tools	Heated forming press	Cutting & forming machine
9. Lead stripping	Hand tools	Wire brush wheels	Wire brush wheels
10. Coil soldering & brazing	Soldering iron	Soldering furnaces — Gas torches	Acetylene torches
11. Winding tests	Growlers — Transformer taps	Heavy growlers — High-potential leads	Truck type growlers Portable switch boards
12. Insulation cutting	20-in. bench shear	40-in. straw bd. shear-Band saw	Strawboard shear - Band saw
13. Benches & stands	2 or more stands & dollies	2 arm. stands 4 stator benches	4 arm. stands 8 stator benches
14. Balancing	Bench roll type	Rotating cradle bearing	Rotating or stroboscopic
15. Banding machine	Lathe	Lathe attachment with tension indicator	Separate heavy duty banding lathe
16. Armature tools	Hand tools	Undercutting attachments	Special milling machine & lathes
17. Dipping tank	Drum	Vats & circulation system	Vats below track or monorail — Pressure tank
18. Baking oven	Small gas or electric	One small — One medium	Small, medium and large roll-in type
19. Handling equipment	Floor crane	Entrance boom — Monorail — Hoists	Monorail — Trav. crane — Local hoists
20. Brush making	Stock brushes	Cutting and beveling outfit	Cutting and beveling outfit
21. Welding	Send away	Arc or gas	Arc or gas
22. Machine shop	Small lathe — Drill press	2 lathes — 2 drill presses — Milling machine — Grinder — Shaper — Power saw — Hoist	3 lathes — 2 drill presses — Milling — Shaper — Power saw — Hoists & cranes
23. Test boards	Bench type scale prony brake	Switchboard & Generator dynamometer	Switchboard-portable high tension testing boards - dynamometer
24. Instruments	Ammeter — Volt meter	One indicating & one graphic set	2 or more sets all types instruments
25. Displays	Brushes — Belts — Bearings	Parts — Supplies — Power & control	Separate show rooms
26. Delivery equipment	Light truck	Service truck — Heavy duty truck	2 or more service trucks — 1 or more heavy trucks
27. Special departments	Appliance repairs	Small motors — Special service depots	Small motors — Transformers — Specialties
28. Spray booth	Bench type	Floor type at monorail	Separate room
29. Presses	Bench type arbor hand jacks	Arbor — Pullers — Floor press	All sizes — Large press, 100-ton up
30. Stock & storage	Parts bins — Insulation & wire racks	Sectionalized by departments	Motors — Apparatus — Supplies — Parts
31. Shipping	Counter service	Crating & Labeling — Clerk — Scales	Separate dept — Saws — Scales
32. Spare parts	Trays	Special bins	Separate dept.

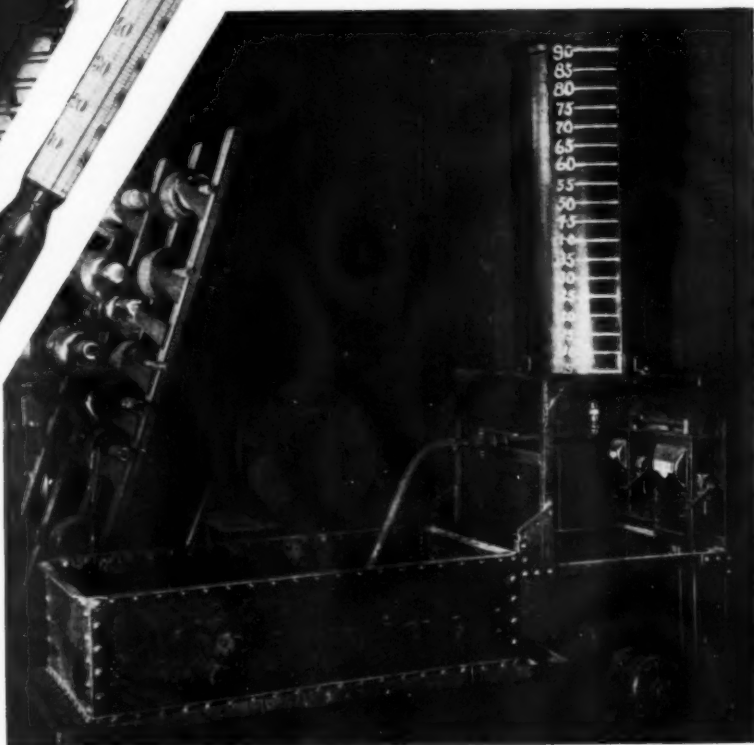


**SPRAY JOB**—Air drying varnish being applied with spray gun for the finish coat.

**GRAVITY INDICATOR**—A thermo-hydrometer for checking specific gravity of varnish to determine amount of thinner needed.



**STORAGE AND FILTERING** equipment in this shop permits varnish to be pumped from dipping tanks into top of container, where it is strained of foreign matter.



## This matter of **VARNISH**

**T**HE selection and application of insulating varnish by motor service shops must be founded on the fundamental reasons why varnish is used. There are two basic functions, of course, for which varnish is applied to electrical windings—

1. It acts as a saturant for fibrous insulation.
2. It yields a protective coating.
- And serving in these dual capacities, varnish is used for five purposes—
3. To bond and prevent chafing of insulated conductors.
4. To increase heat conductivity and reduce hot spot temperatures.
5. To protect against moisture, oil, acids and metal dust and prevent these elements from entering the winding.
6. To provide electrical insulation.
7. To improve the appearance of assembled coils or windings.

All of these characteristics are generally desired in present day electrical operations but some are of extreme

importance for certain applications. For while compact bonding of conductors is vital for high speed tool or drill armatures, resistance to oil and chemicals is a major requirement for varnish applied to motors operated in a textile plant.

### How to Select Varnish

Insulating varnish is too often considered a purchase item of minor importance. As a matter of fact, before a varnish is selected, careful thought should be given to the particular job it is to do, and the results that are to be obtained. For example—

1. Motor repair shops usually standardize on an oil-proof black baking varnish for general purpose work. It enables a more uniform color scheme to be carried out for frames and housings.

2. On the other hand, some shops prefer the clear types owing to their ability to show up good workmanship.

3. Most repair shops also stock a quick-baking grade for use on jobs where time is a vital factor.

4. Spirit varnishes, which air-dry in half to one hour, are not substitutes for longer air-drying or baking grades. Their characteristics make them entirely unsuitable for application to "green" coils. They are only intended for use as a finishing coat over a previously insulated winding.

5. For high speed armatures the modern synthetic gum base varnishes should be selected, because they have heat curing properties and "binding" qualities not available in conventional oleoresin varnish.

These examples illustrate that insulating varnishes cannot be picked at random from a manufacturers' list. For satisfactory results, the entire job should be considered and all the desired insulation characteristics tabulated. The manufacturer can usually match these specifications from standard lines or produce a special grade.

The right amount of varnish to buy depends on the size of shop, capacity of dipping tanks, and number of units to be insulated. For treating a large number of preheated units, the volume of varnish should be sufficient to dissi-

(Continued on Page 36)

# LOW COST PHOTOELECTRIC

## Control

**F**OR a number of years photoelectric controls have been on the market which turn off lights when illumination from outdoors is high and let them come on again when daylight decreases. The price of these equipments, has been high, due to small quantity production, and their acceptance has not been widespread. A new device is now available, at a low price.

In deciding whether or not automatic control will add to the value of a lighting installation, the first point to determine is whether there is natural daylight of sufficient quantity for enough hours to warrant the installation of a device to turn artificial light off automatically. Unless window areas are exceptionally large or other daylighting conditions are particularly favorable, it will usually be found that areas more than ten feet away from the windows require lamps burning continuously. Under such conditions obviously an installation of phototube control would not be justified.

The apparatus, as pictured, consists of two parts, one housing the photoelectric tube or "electric eye" with its amplifier and adjustment knobs, and the other comprising the relay and 30 ampere contactor which respond to the effect of light upon the photoelectric tube. The latter part forms an essential part of the control, and since it can be remotely located, all of the elements which make any sound whatsoever may be removed from the room where the lighting is.

The decision that such a control can be used profitably will depend upon a number of limiting factors. The photoelectric tube unit should be mounted where:

1. It is out of reach of unauthorized persons.
2. It will be exposed to the sky, the source of natural light.
3. It will not be exposed to direct sunshine.
4. The vertical daylight illumination on the opening in the phototube cover, at the proposed location, will be at least three footcandles, when the illumination on the working plane is at the point when artificial lighting becomes necessary.
5. The vertical illumination at the phototube opening will increase by at least two footcandles, when the natural illumination at the working plane increases approximately 5 footcandles.
6. The phototube will not receive more than 20 footcandles of artificial light.

In order to obtain these conditions, the phototube holder, which is mounted in a ball and socket joint, may be turned

by Phelps Mecker

General Electric Company  
Nela Park Engineering Department  
Cleveland, Ohio

to find the most favorable direction of aiming. The potentiometers which serve to adjust for the desired limits of illumination provide a range of from well below any ordinary usable illumination up to a maximum of approximately 50 footcandles. The control is so designed that artificial illumination falling upon the phototube will not cause false operation.

The electrical wiring required for the control circuit consists of a supply of alternating current voltage to both parts of the equipment, and, in addition, three conductors connecting the two parts. The power contactor which consists of a single pole double break switch can be cut into a load circuit, or an auxiliary magnetic switch coil circuit, in the same manner as any switch or contactor.

The phototube housing illustrated, is of the flush type and is arranged to be

set in a three gang switch box. The surface type is provided with a drawn steel box to enclose the parts behind the panel.

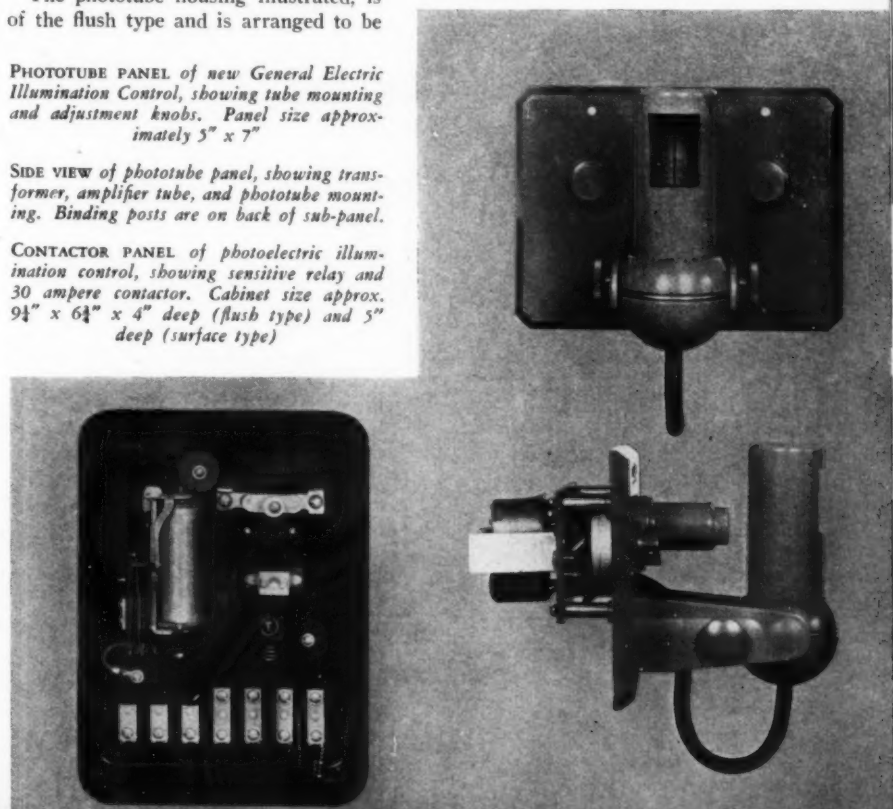
The circuits controlled by the delicate telephone type relay, which is in turn controlled by the output of the amplifier tube, are so arranged that the contacts are required to break very small currents and accordingly this relay should suffer practically no wear. The phototube and amplifier tube have a very conservative rating and should therefore give satisfactory service for many years.

It is entirely practicable to make an installation involving a single photoelectric control to handle a number of lighting circuits in adjoining rooms, providing they are all exposed to the same outdoor conditions. If this result is desired it is necessary to use an auxiliary multiple pole contactor, each leg of which may be inserted in a corresponding circuit conductor.

**PHOTOTUBE PANEL** of new General Electric Illumination Control, showing tube mounting and adjustment knobs. Panel size approximately 5" x 7"

**SIDE VIEW** of phototube panel, showing transformer, amplifier tube, and phototube mounting. Binding posts are on back of sub-panel.

**CONTACTOR PANEL** of photoelectric illumination control, showing sensitive relay and 30 ampere contactor. Cabinet size approx. 9 1/4" x 6 1/4" x 4" deep (flush type) and 5" deep (surface type)



# Short Cuts on R

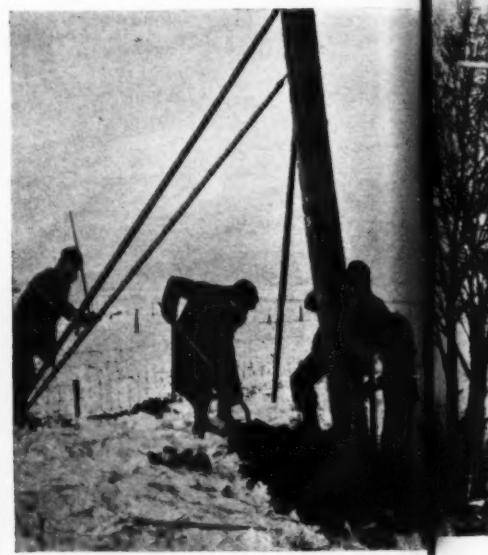
How one electrical contractor is advancing farm electrification in Iowa by devising labor saving methods to suit the farmer's need.



RURAL LINES over Eastern Iowa being installed by trained crews with modern equipment and methods.



ENGINEER Wayne Peak and Superintendent Jack Palmer handle the details of progress and organization from a field office.



SETTING CREW armed with pike poles, shovels and tamps, set the poles as the tractor pulls out for the next stake.

TRUCK  
special  
tion cr

**O** LIN is a small crossroads town in the heart of Eastern Iowa's fertile farm country. A large garage building on the "four corners" houses the job office and warehouse of the Marshall Electric Company of Marshalltown, Iowa. Wayne Peak, son of Earl Peak, president of NECA, is the chief engineer in charge of putting through 300 miles of "high line" to serve over 1000 farms in this area.

This job is typical of R.E.A. line construction in the great farming country in the Mississippi watershed. Through the efforts of R.E.A. engineers, specifications for rural lines have been standardized and simplified. Modern equipment, layout and management by the electrical contractor have translated these specifications into low cost lines. They average \$946 dollars per mile, including transformers, meters, engineering, easement and legal costs.

This Eastern Iowa line construction project will cost on an average about 800 dollars per mile exclusive of engineering and legal fees. The system consists of 7500 volt, Y distribution lines with single phase branches terminating in individual transformers at the service drop tap. Where farmsteads are grouped a single transformer may serve several properties.

For efficient operation crews are organized to handle each step of the line installation separately. Schedules of each section of the line, giving details of pole size, setting, hardware, are placed in the hands of the crews. Pole handlers then roll off the "sticks" after the settings are spotted and staked. Assembly crews follow mounting all hardware, guys and insulators. This is a ground operation handled by a crew of four men.

Pole handling tractors each manned

by a driver, operator and "mucker" follow up the assembly gang. Holes are dug with a rotary auger while the "mucker" ties onto the pole. The pole is then hoisted with all cross arms and hardware in place and dropped into the hole ready for the pole setting crew. This entire operation in ordinary soil takes about three minutes. Five-man setting crews plumb and tamp the poles, set anchors and complete the guys ready for wire stringing.

Tree cutting and trimming takes up slack time in balancing the operation, the regular gang being augmented by men from other crews to smooth out the work. Where special poles or difficult settings are encountered, a clean up gang follows up with a truck equipped with an A frame pole hoist. This crew handles all the odds and ends along the line which would slow down the production crews.

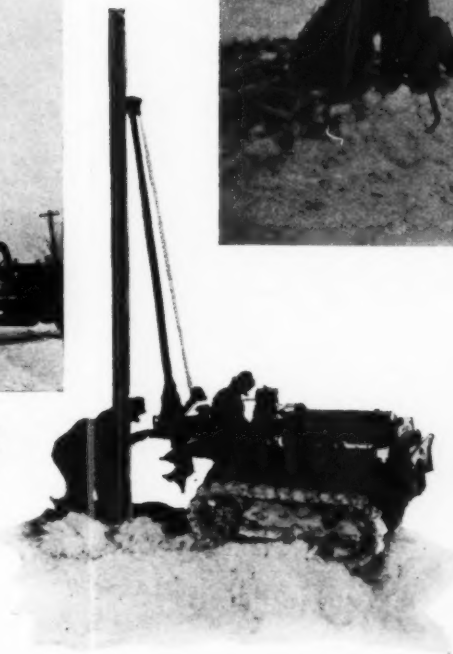
# Rural Lines

By William T. Stuart  
Middle West Editor

GUY ANCHORS are installed and guy wires stretched and clamped by the ground crew, which follows next.



TRUCK RIG is completely equipped to handle special poles and clean up work. Production crews are not delayed by extra jobs.



POLE HANDLING tractors, known as "cats" climb ditches and cross fields. Equipped with auger and boom, they erect a pole in three minutes. (Above.)



UNLOADING one of the "cats" from the special trailer used to haul them to and from the job. The boom is dropped back to clear overhead wires. (Above right.)

Wire stringers complete the line ready for transformers and secondary service drops. Sag is pulled up in one mile sections with telephone intercommunication between the linemen.

These economies of production line methods and unit operations are made practical only by close and careful management and proper material delivery routine according to Mr. Peak. This means an efficient office and engineering staff. It also requires first class tool equipment.

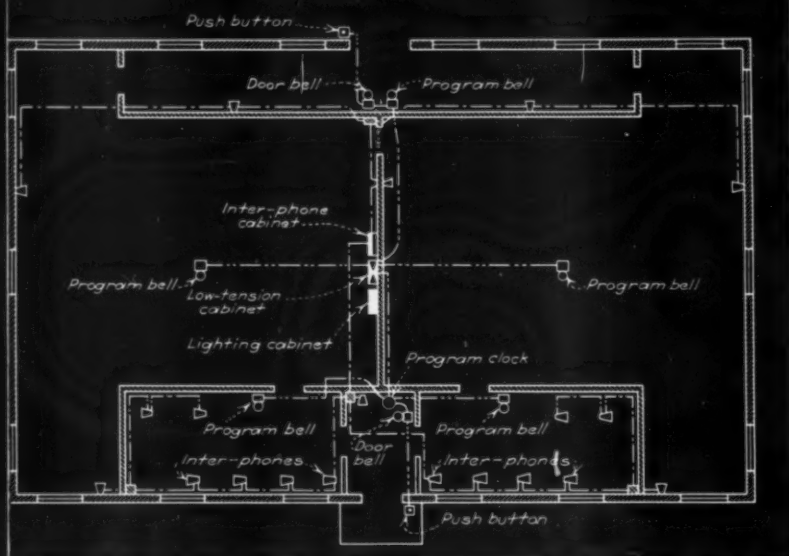
And so a web of power lines is spreading over the land, carrying all the modern benefits of electric service to the farm. It is only right and natural that new ideas, new methods are being worked out by modern contractors.

AND PIE—It isn't all work. The gang with their families enjoy a big Christmas dinner in the Baptist Church as guests of the "boss." (Right.)



Electrical Contracting, April 1938

# Selecting



**SIGNAL LAYOUT**—Signal functions are an important consideration when planning wiring systems. This diagram shows provision for eight types of devices.

**I**N determining the proper type of signalling devices to meet the requirements of various services, many factors must be considered. To a large degree, the selection will be dependent upon the type and construction of the building in which the apparatus is to be used. Also, the type of industry requiring the service makes a big difference. Sometimes the type of organization occupying the building is important. Whatever it is, it is worth considering and providing for. There are many factors to be checked, therefore, in planning a modern signal system, and the following detailed suggestions are offered as a guide.

The location of signalling devices, primarily, should be decided upon the basis that will assure convenience, expediency and safety to the individual or the organization using the apparatus. Audible signalling devices, such as bells, buzzers, horns and sirens are known to have a specified range of audibility under favorable conditions. In actual practice, however, many factors tend to reduce this range. It may be noises of various descriptions, obstacles in the path of sound, perhaps wind blowing toward the source of the signal. It is with this thought in mind that these suggestions are given.

## 1—In Quiet Locations

- For non-coded general service, small vibrating bells, buzzers, chimes, and tappers may be used. This includes call systems, door calls and program systems.
- For coded service, small single-stroke bells, tappers, chimes and sounders are preferable. This includes paging and fire alarm systems.

## by Albert A. Schuhler

Signal Engineer  
American District Telegraph Company  
Washington, D. C.

tems where clear-cut signals are necessary.

- For visual signals, electric-reset, hand-reset and lamp annunciators, or pilot lamps may be employed. These are for use in offices, residences, dormitories. Lamps under domes should be in duplicate and connected in series to prevent total failure.

## 2—In Noisy Locations

- For non-coded general service, large vibrating bells, buzzers, horns, sirens and howlers offer a selection. This includes call systems, alarm and program systems.
- For coded service, large single-stroke bells, tappers, horns, sirens and howlers may be used. This embraces call systems, paging and fire alarm systems.

## 3—For Distinguishing Tones

- Similarity of signals for various systems should be discouraged, as this method defeats the purpose for which the systems are intended. Each system should have a distinctive signal and tone to prevent confusion.
- The number of signal devices placed at one location should be restricted. Bells and buzzers are made in different tones, yet many individuals cannot readily distinguish between them. Annunciators should be used wherever possible.

sible therefore, when a number of signals terminate at one point.

## 4—For Overcoming Prevalent Sounds

- Noises of machinery on other operations must be studied. A comparatively smaller bell may often do the work better than a larger bell due to the difference in tone or pitch. A small bell may overcome a deep toned noise. A large bell may overcome a high-pitched noise.
- A number of small audible signalling devices evenly distributed over a specified area is often found to be better than one large unit.
- Where bells do not solve the problem try horns or sirens.
- In extreme cases electrically tripped air or steam whistles may be best.
- Sometimes additional extension audible signals may be used with satisfactory results.

## 5—Visibility Range

- Lamp annunciators should be used where signal indications are to be seen from a distance. The standard range is from 50 to 200 feet.
- Pilot lamps are effective as extension signals to support certain indications on annunciators or other pilot lamps.

## 6—For Multiple and Series Operation

- Contact type bells, buzzers or horns may only be connected in multiple.
- Non-contact bells, buzzers or horns may be connected in either multiple or series.
- For simultaneous operation of audible signals in multiple, all devices must be of the high resistance type.
- Devices wound for one voltage should not be connected in multiple with devices wound for other voltages. The lower voltage devices would burn out contacts and coils under this condition.

## 7—Methods of Enclosing and Mounting

- Audible signals may be mounted behind grilles. Since the volume of sound is reduced slightly,

# Devices for Signaling

a somewhat larger unit should be installed.

- b. Bells having non-insulated mechanisms should be mounted on wood or other insulating mats. They must never be mounted directly on a wall having metal lathing or to an outlet box.

## 8—In Dry and Wet Locations

- a. In dry locations any audible or visual signal or contacting device may be used.
- b. In damp interior locations weather-proof equipment must be provided.
- c. In wet locations watertight equipment is needed.
- d. Audible signaling devices for mounting on the exterior of buildings should be enclosed in housings or grilles.

## 9—Protection Against Gases and Fumes

- a. Audible signaling devices subjected to gases and fumes should be of the non-contact or explosion-

proof type.

- b. Contacting devices subjected to gases and fumes should also be of explosion-proof design.

## 10—Load or Contact Capacities

- a. Contacting devices such as push-buttons, switches or relays must be selected on the basis of the load of the system or circuits which they are to control, and the current and voltage to be employed.
- b. Low-voltage contacting devices designed for voltages up to 24 must not be used on 110 volts.
- c. Lightly constructed pushbuttons should not be used for heavy duty service, as they are primarily de-

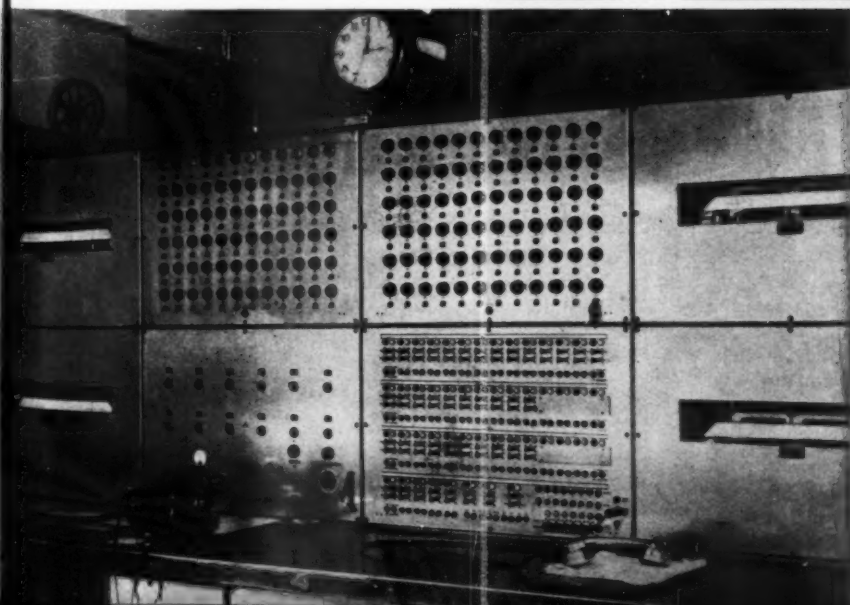
signed for intermittent service on light loads.

## 11—Source of Current

- a. Separate sources of current are desirable for each signaling system. This will prevent interference between systems.
- b. Separate sources of current also are desirable for each floor of a building. This will isolate trouble to a given area.
- c. Sources of current should be centrally located. At these points wires should terminate and be brought to terminal strips. In addition circuits should be properly fused.

**HOSPITAL RECORDER**—Doctors register "in" and "out" on two large units like this. Registration is duplicated at the telephone switchboard to avoid confusion.

**FIRE CONTROL**—A large office building's fire alarm control board, suggests the maze of stations which comprise this system.



- d. Storage batteries should be combined with proper charging apparatus. The batteries should be located in well ventilated rooms and, if possible, be isolated from the charging apparatus. In manually charged systems, the batteries should be in duplicate.
- e. The source of current for a fire alarm system operated from a lighting system should be taken at a point ahead of the building meter. This will prevent failure should main fuses "blow" on lighting and power systems.



LOOKING DOWN on the battery of 500 watt floodlights inside the first floor ledge.

**C**HICAGO'S famous loop district has a brilliant new nighttime landmark—the Edison Building at Adams and Clark streets. Here the Commonwealth Edison Company placed a new floodlighting system in service December 6. This modern installation is of special interest because it adapts the



FLOODLIGHTING brings out the architectural beauty of this Chicago building in striking contrast with the dark surroundings.

# Floodlighting

## DE LUXE

latest developments in this type of outdoor lighting to the architectural character of an existing commercial building.

This floodlighting job was designed by the Commonwealth Edison Company illuminating engineers in cooperation with Shaw, Naess and Murphy, architects. Installation of the equipment and the electric wiring was handled by Ernest Freeman & Co., electrical contractors, of Chicago. In advance of the actual installation, a scale model, 7 feet wide and 4 feet high, of the lower portion of the building was constructed in the company's lighting laboratories to permit tests of different floodlighting plans and various lighting intensities. The four lower floors of the large office building are illuminated. A ledge above the first floor windows conceals the batteries of floodlights which throw light upward bathing the second, third

and fourth floors with light, while other lights illuminate the first floor and sidewalk.

The lighting system accentuates the beauty of the Corinthian pillars surmounting the first setback on the building. Venetian blinds have been installed in show windows of the recently modernized Electric Shops on the first floor of the building and in office windows on the second and third floors to enhance the attractiveness of the lighting and minimize reflections in the glass.

More than 550 lamp bulbs are concealed in a cast aluminum canopy, specially constructed in harmony with the basic architectural design of the structure. A total of 184 reflectors, containing 500-watt lamps, floodlight the area above the first-floor ledge. The area below is illuminated by 150-watt lamps through 370 diffusing-glass windows.

*Electrical Contracting, April 1938*

-and so a trend is born

**J**UST as a pebble dropped in a pool sets in motion waves which sweep to either shore . . . so the seemingly most trivial circumstances can create new demands which in ever-widening circles sweep the country. The only way to prestige and profit is to catch these trends in the making and ride with them to success.

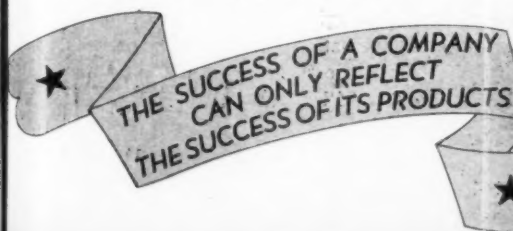
It is typical of Cutler-Hammer Engineering Leadership in the field of Service Control, that Cutler-Hammer is ever studying the changing needs of consuming

public, of local utility, of electrical contractor and wholesaler, and with that awareness of changed demands goes the engineering ability, resourcefulness, experience and knowledge that knows when to change, how to change, what to change.

And so, Cutler-Hammer Service Control continues to win the preference of all men connected with the domestic consumption of electricity. CUTLER-HAMMER, Inc., Pioneer Manufacturers of Electric Control Apparatus, 1306 St. Paul Ave., Milwaukee, Wis.

4334H17 fuseless main switch; the greatest single contribution to service equipment; the talk of the field. Geared to the 1937 National Electric Code, it permits the highly desirable 60 ampere service at little more than 30 ampere cost.

4334H15 the outstanding pull-out type combination main and range switch. Built to make installation easier, to reduce service calls and to make periodic inspection possible without interrupting service.



# Editorials

Earl Whitehorne, Editor

## Fire Escapes Need Alarms

After a wave of moron murders, Chicago now has a law. "In all Class II buildings, (hotels, dormitories) where sleeping accommodations are provided and which are provided with outside fire escapes, each fire escape shall be equipped with an automatic electric alarm apparatus —".

This will mean some business for electrical contractors, small jobs individually, but small jobs that will add up to an impressive total. And, in addition, some contractors are going to have a splendid opportunity to sell more elaborate burglar and fire protection.

But why wait for a law? Your daily newspaper carries stories of criminals using the fire escape as a means of entry. Why not cut them out, get reprints and go after the colleges, hospitals and hotels in your town while the story is hot and folks are scared. Sell fire escape alarms. You will help prevent the crimes that make such a law necessary.

## "Guaranteed For Five Years"

Earl Peak, after a speech one day, in Tulsa, Oklahoma, visited a local contractor in his shop. He looked over his system and was surprised to note a line printed at the bottom of his proposal forms. It read—*"This installation is guaranteed for five years."*

"How long have you been doing that?" he inquired.

"A long while," said the Tulsa contractor.

"How much has it cost you?" asked Peak.

"It doesn't owe me a cent," was the answer. "To the contrary. It pays me a profit. It costs nothing to guarantee good wiring installations, because when they pass inspection they are right and they stay right. When we see them again, it is because the customer wants something changed and he pays for it."

Here is a profound truth that most electrical contractors are completely overlooking. And as a selling influence, it is worth far more than you can calculate. For that one line of printing establishes confidence. And confidence must be sold to every new customer and resold with every job. Nobody buys unless he believes he will receive both good workmanship and protection. And a guarantee covers both.

Here is a bit of selling that every contractor can employ to make more money. Why not? Have a rubber stamp made and start using it at once.

## Better Training for Electricians

Schooling for skilled electricians, has grown out of the apprentice classes organized by the Milwaukee local of I.B.E.W. It keeps members of that union up-to-date on new developments in their trade. It came because some of the men, listening in on apprentice classes, learned things and clamored for an advanced journeyman's class.

Contractors have relied largely on the virtues of experience to train men. Four years on the job as a "helper", plus a brief cramming on the code to pass the journeyman's examination, has been the educational history of the average union electrician. For that is

all the industry asked—just preliminary training to acquire mechanical skill and enough familiarity with the code to keep out of trouble.

As journeymen they gained more skill. They learned about new products and new methods the hard way. In many instances they learned at considerable expense to their employers.

But high hourly scales and narrow profit margins today make it economically impractical to permit trial and error learning on the job. New and increasingly complex devices are being handed over to the electrician to install, which demand more knowledge and more skill. Some means of keeping mechanics informed and competent to handle new devices therefore, becomes vitally necessary. The only alternative is more expensive engineering supervision.

The Milwaukee class points to one answer, a school organized within the local union. There is no reason, however, why local contractor groups cannot assume leadership in such a project.

## "Wholesale Only" — Says Who?

Contractors get pretty sick of electrical jobbers who have a "wholesale only" sign by the front door and then sell retail in the rear. It is a pernicious influence in the trade. It should be stopped.

There is no use arguing about the ethics of it. It stands out just as clear cut as the difference between right and wrong. But what is the good of subscribing to the "wholesale only" policy, as almost every wholesaler will do, and then not sticking to it?

Many a house manager believes in the policy and will protest that he lives up to it. But down at the counter his clerks have an easy conscience and he may know it and he may not—in detail. But all the time, this friend and that is coming in and buying things at the trade price. People not entitled to it are getting the margin, that is provided as a compensation for a service rendered in the orderly functioning of the electrical business.

*Electrical Contracting, April 1938*

Competing department stores in the large cities send shoppers around to buy and check up on prices that are being charged. It couldn't do a bit of harm for the contractor to do a little spotting on occasion. Then when the salesman comes around, lay down the evidence, where the proffer of service and cooperation does not prove out.

Better yet, the wholesalers of every city should police themselves cooperatively for the good of their own business. It would certainly please their regular customers. And it would save them a lot of profit now thrown away—God knows why!

## Qualify For Rural Work

Contractors should read the annual report of the Rural Electrification Administration. A copy of it can easily be obtained from Washington. Viewed from the angle of the large volume of wiring business that is involved, it is important.

In a word, some 41,000 miles of rural lines were built by REA last year, and about 32,000 miles by private utilities. And whereas the power companies electrified 34,000 farms, in 1933 and '34, in the two and a half years since REA was established they have connected 300,000 farms. REA projects have brought electricity to some 250,000 rural people.

There can be no question, therefore, that this government activity has speeded the development of farm electrification. No one can question either, that some of the co-op construction has been bad, that much poor workmanship has gone into inadequately wired farm buildings. But that could be expected in so rapid a movement, in the hands of so many inexperienced agencies. Now comes the next phase and here is where the interest of the electrical contractor lies.

More lines are to be built this year and next. More farm buildings are to be wired. What are we going to do to get more of this work into the hands of qualified contractors? The farmer is new in this matter of electricity. Why should he be expected

to know what to do? He must be told. He must be sold. And if the qualified contractor wants his business he must go get it.

This calls for energetic, intelligent selling. It also calls for thorough understanding of the farmer's needs and attitude. Moreover, just as the selling must be done in a way that will appeal to the farmer, the wiring itself must be planned and handled in a manner suitable for the farmer. This is not town construction. It is farm construction, entitled to many short cuts and economies that will give the rural customer more for his money.

If the qualified contractor is to enjoy this business he must become part of this movement. And he must qualify himself to do this work.

## Back Talk

### "An Idea to Kill"

Many letters have come to us commenting on the article—"An Idea to Kill"—published in our February issue. In it we challenged that group of power company men who so long have preached that wiring now costs too much to be contractors, wholesalers and manufacturers almost uniformly endorsed our argument. A number of power company men criticised us severely. But to our gratification, for every criticism there came more letters from utility presidents and sales executives supporting our appeal, that while the industry goes forward developing new materials and advancing the art, we all quit saying that "wiring costs too much." It discourages electrical salesmen who should now be enthusiastically promoting the new Adequate Wiring Bureau's campaign. Here's what they said—

1. The president of a New England utility writes—"I will go further than just agree with you. Certain men connected with the power companies have been deterrent to more adequate wiring because they have shown requirements and regulations that have increased the expense. Electrical contractors themselves have been responsible for a lot of trouble. For a number of years our company has provided free consulting service to people building or remodeling houses. Our biggest job was to sell these adequate wiring plans to the contractors. I think you have started something worth while and I hope you have the courage to follow it through."

2. The president of an eastern power company says—"I do not believe the systems of wiring now in use are any safer than they ought to be. I do not see quite how the prices can be materially reduced. You certainly have the right point of view."

3. A southeastern utility sales executive writes—"Perhaps the power men are at fault in not having some good arguments to sell the customer on the value of the job he gets. I believe as you do that better selling is required."

4. The president of a far western utility writes—"You are correct in pointing out that price is by no means consideration No. 1. You are doing a service to all parties and interests."

5. The vice president of an eastern power company says—"Our attitude is that wiring

can be sold with materials in common use at the moment."

6. The general sales manager of a utility in the far south writes—"I agree with you 100 percent. We still find the idea prevails that wiring costs too much. But it is not so much the cost. Even if it were free, we still would not have 100 percent wiring in houses. We still have a big educational job ahead. I hope you will pursue this theme."

7. A utility sales executive in the northwest says—"I heartily agree with everything you have said. You have hit the nail on the head in pointing out that it is a selling job. The total cost of adequate wiring is a very small percentage of the total cost of a home. I say keep it up. You may offend a few, but the majority will be with you."

8. A Pacific Coast president says—"That we can sell wiring at the present price is proven. But we both agree that lower prices would increase sales."

9. The president of a large western system writes—"I agree with your conclusions. The handicaps can be overcome by intensive sales and educational efforts."

10. A southern vice president says—"I thoroughly agree with you that we cannot get the prices down by talking about the high price of materials. We can only get it down through increased volume and simplification of unduly burdensome code requirements. I think the article will have a good effect."

Many of these letters from power companies also stress the belief that code restrictions are too stringent and approval procedure is too slow. Some feel deeply that progress is blocked by the present cost of wiring. Among them these—

11. The vice president of a middle west utility writes—"I distinctly do not agree. These men protest against the airline attitude of many in the industry who have kept wiring costs higher. But they have not stopped preaching wiring in homes as you infer. Your article is not fair. Some of your statements are not correct."

12. Another vice president of a north central company says—"I have never heard of a 'crusade of can't' but you seem to be doing a very good job in creating one. Utility companies have consistently spent their time, money and effort promoting adequate wiring. Other branches of the industry have spent their time almost exclusively in increasing the cost of wiring by ordinances and underwriters rules that are unnecessary. I think your article most unfortunate. You could do a great service to the industry by getting behind modern developments, which have made cheaper wiring possible."

13. An eastern vice president writes—"I do not agree with the main implication of the article, that low cost wiring is an idea to kill. I doubt if any reasonable person could note the electrical industry's experience and say wiring can't be sold. The utilities are endeavoring to lower the cost of wiring by every means they can employ."

14. An eastern power company president says—"Electric utilities are not trying to discourage the sale of any of the improved types of wiring, however expensive. Their fight has been against code restrictions not justified on safety grounds."

15. Another eastern vice president says—"I wish you hadn't written it. I agree with your three sentences—'Let us have every possible reduction in the cost of wiring. That is only sensible. It will help our selling.' Only I don't think you are helping toward that end with this kind of article."

16. A middle west president adds—"I do not agree. I would work toward having stringent code specifications modified and endeavor to sell inspectors on not making the cost of wiring higher than it otherwise would be. If there were a cooperative action by all concerned to reduce the cost of wiring, it would be reduced."

It would seem, therefore, that manufacturers, wholesalers, contractors and the majority of power company men believe with us that wiring does not now cost too much to be sold. Also, we heartily agree with those who condemn our article when they say that we should strive to advance the art by the use of new methods and materials that will reduce costs. The article said so. But we still believe that better and more selling is far more important and should not be discouraged by negative talk.

# WIRING

## Methods

### CANADIANS MODERNIZE

In the City of Montreal there are many old buildings containing examples of early-day wiring. These are giving way to new systems as greater lighting demands require alterations and additions.

A job now in progress covers the



**MORE SPACE**—New sequence metering equipment and telephone cabinets in old Montreal building placed where there is elbow room, and it is handy for running larger conduits



**SIDEWALL PICKUP**—Old-style concealed circuit wiring was collected in exposed cabinets from which points new conduits and conductors extend to enlarged metering centers

installation of new feeders, metering centers, circuit home runs and telephone risers for the original quarters of an insurance company. Here Joseph Gregory laid out exposed vertical runs in central locations, where more liberal space was available for the equipment.

Some of the old buildings still use conductors which were concealed in tile walls and above the ceiling plaster. Because such wiring often tests out with good insulation values, it is left intact up to a point where new home run conduits can be terminated in a collecting or splicing cabinet. From these new cabinets, the new system of conduits, conductors and equipment is installed complete to the service equipment.

### RECORDS FOR MANY TOOLS

Contractors, with two to ten thousand dollars invested in tools and equipment, need accurate office records to quickly check up the requirements for large short-notice jobs. One large industrial contracting organization has worked out a simple card filing system, which has been found satisfactory for this purpose.

This company owns about 860 items of tools, which fall into 157 master alphabetical classes. These items are individually recorded on 4x6-in. file cards, which are filed under their master tabs, in a card tray or drawer. When a load of tools is sent out to a job, cards for each item are transferred from behind their master tabs to a temporary job tab in the same file drawer bearing the job name.

With this system, the tool record card file provides a quick checkup at the office as to the tools out on jobs, and those on hand in the stock room for starting a new job. This card system is also valuable at inventory time, and for recording tools that are becoming obsolete or that need overhauling.

Where twenty-five or more tools of one kind are involved, they are not all

entered on separate record cards. A portion of them are posted in quantities of five, just as they would be required for larger jobs.

### CAPACITOR MOUNTING

Mounting the capacitor on the wall away from the motor improved the accessibility of a three horsepower single phase motor on a deep well pump. The Dix Kelley Electric Company of Ft. Wayne, Ind. installed this vertical mo-

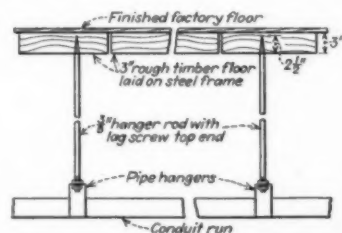


**CAPACITOR** is mounted on the wall to clear space around the motor for servicing.

tor in a small basement area on a rural estate. The capacitor is shown at the right of the photograph. The automatic controller is mounted adjacent to it in the corner.

### LAGGED HANGER RODS

Runs of larger exposed conduits were supported from rough floor timbers by means of one-piece lag type hanger rods, when the Lord Electric Company wired a group of industrial buildings



**LAGSCREW SUPPORTS**—Large conduit suspended with ring hangers using lag screw hanger rods for rough plank-ing of upper floor.

in Cambridge, Mass. The lag screw hangers were installed in lines according to predetermined conduit routings, after which the lengths of conduit were coupled while suspended in the ring



## SIMPLICITY IN SAFETY SWITCH DESIGN MEANS LESS HEATING

One-piece copper parts in Westinghouse Safety Switches assure cool operation at all times — there can be no heating from loose connections.

And years of trouble-free service are assured by these added Westinghouse features: Diamond pointed jaws and extended blades confine beading

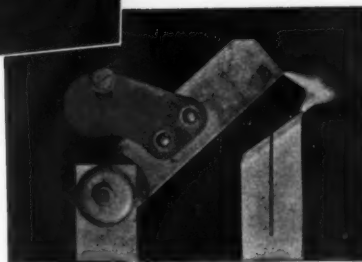
to points outside the contact areas . . . the "De-ion" feature on all Westinghouse 575 and 600-volt switches quenches destructive arcs almost instantly.

Reduce your service worries —standardize on Westinghouse Safety Switches. All commercial types and ratings available from your electrical wholesaler.

WESTINGHOUSE ELECTRIC & MANUFACTURING CO., EAST PITTSBURGH, PA.



The exclusive Westinghouse diamond pointed jaw confines the bead to sections outside the contact area, sections which do not normally carry current.



# Westinghouse Safety Switches

MOTORS • CONTROL • CIRCUIT BREAKERS • SAFETY SWITCHES • PUSH BUTTONS



## FLEXIBILITY



More than 1500 styles.

Each one made to do a particular job and to do it well. Send for catalog.



### makes KILLARK FITTINGS the perfect choice

Out in the mountainous regions of Utah stands today a Juniper Cedar reputed to be older than Christendom; twisted, turned, and bent by centuries of exposure to destructive forces. But, it is still alive!

Fittings, too, need flexibility and it is built into every one made by Killark to give them longer life—a life that is measured by its resistance to the forces of destruction—abrasion, heat, light, impact, and so on.

To those who know, this quality is vital—so vital that we use only the finest malleable procurable.

Use Killark Fittings on your next job and add mileage to the work.

**KILLARK ELECTRIC MFG. CO.**  
Easton and Vandeventer Ave. St. Louis, Mo.

## WIRING Methods

[FROM PAGE 28]

hangers that were attached to the bottom of the rod. Final levelling of each run was made with the double nut takeup at the bottom end of the rod.

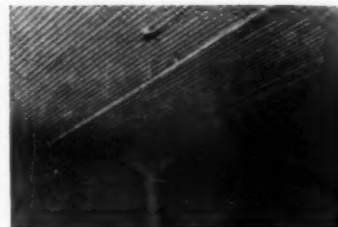
### REWIRING ABOVE TIN CEILINGS

Flat pans solved the re-wiring problem in an old building finished off with metal ceilings. The job was handled by the Sturgeon Electric Company, Denver, for the Golden Eagle store.

Flat outlet pans were laid below the original ceilings with fixture bar above, and pan and lock nut below. Armored



**FURRED SPACE**—Flush light boxes placed in furred beams adds illumination between rows of new ceiling fixtures



**ABOVE METAL**—Large metal ceiling store areas rewired with concealed armored cable, using flat ceiling pans on under side

cable was fished in to render the complete job concealed. The metal ceilings on the upper four floors were thus left undisturbed in remodeling.

On the same job four beams were built down and wired within the furring space to provide indirect lighting. Flush lighting panels for these beams were formed by ten 12-inch square removable sections of frosted glass, so that repairs can be easily made. There are ten 150-watt lamps equipped with mirror reflectors for each panel.

In all, 40 circuits were installed for beam lights and 40 for ceiling lights, with every other light connected on a circuit. To give plenty of light and capacity, every outlet is connected to an individual circuit.

*Electrical Contracting, April 1938*

VARNISHED CAMBRIC • RUBBER POWER CABLES • BUILDING WIRE • RADIO

WIRE • BARE WIRE • MAGNET WIRE • SERVICE ENTRANCE CABLE • CRESFLEX NON-METALLIC SHEATHED CABLE

WIRES • SIGNAL CABLE • FLEXIBLE CORDS • LEAD-ENCASED AND PARKWAY CABLES • ARMORED CABLE

40 ACRES OF APARTMENT HOUSES  
with 3500 feet of River Frontage



JULIA  
LATHROP  
HOUSING  
PROJECT

Chicago, Ill.

Electrical Contractor  
Wadford Elec. Co.  
Chicago, Ill.

WIRED WITH

# CRESCENT ENDURITE

INSULATED WIRE AND CABLE

Represented here is one of the largest Government low cost housing projects, completed in recent years, using millions of feet of CRESCENT ENDURITE Rubber Insulated Building Wire and Cable conforming to Federal Specifications JC-106.

It is on such low cost, highly competitive jobs that the uniformity, excellence and easy fishing quality of CRESCENT Wire fit perfectly into the picture, providing low cost installation and, at the same time, a guarantee of a profitable return to the contractor. Using CRESCENT puts you in a position to effect definite savings no matter what size the job, even under the most difficult installation conditions.

**CRESCENT**  
**INSULATED WIRE & CABLE CO. INC.**  
TRENTON, NEW JERSEY

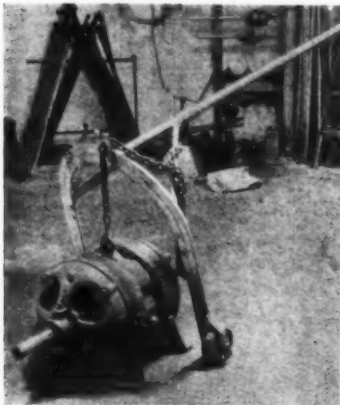


CRESCENT ENDURITE SUPER-AGING INSULATION • WEATHER PROOF WIRE

# Motor Shops

## QUICK FLOOR PICKUP

It is a nuisance to use the big crane, or a smaller traveling crane, to lift every small motor around the shop. So the California Electric Works, San Diego, California, devised a dolly for handling single motors that is the acme of convenience. A horseshoe was made of double angle iron, with a caster on each end to straddle the motor. From a slot at the top of the horseshoe a piece of chain may be set at any distance required; its hook just above the



**MOTOR STRADDLER** — U-shaped dolly with lever for moving motors.

motor to be picked up. A long handle, as shown in the illustration, gives leverage by which the motor can be picked up easily and moved on the casters to any place in the shop.

## WASTE CONTROL

Large shops usually stock such a wide variety of insulation sheets and tubes that wasted and damaged materials involve a considerable cost per year. At the Central Armature Works, Inc., of Washington, D. C., the remedy is a prudent investment in modern



**STOCKROOM ECONOMY** — Expensive sheets and tubes of insulation kept in order on separate steel trays of sectional shelving.

shelving. Sectional steel bins accommodate large sheets of fish paper, fibre, and mica, laid in flat. Here the items are kept separate as to thickness and grade of material. The insulation requirements for a particular motor or transformer job can be obtained quickly, without scattering unneeded types of material around to become damaged or misplaced. Bins at the right background provide separate storage for a wide assortment of stock bronze for bushings and sleeve bearings.

## RENEWING FAULTY ARMATURES

When large armatures develop trouble, the Electrical Motor Repair Company of Trenton, N. J., makes every effort to weigh the economy of complete rewinds as compared with patching those coils found to be defective. Here is a 25-h.p. d.c. armature, in which two shorted coils were located. Repairs are being made to these coils, and several segments of the commutator are being re-micaed.

Coming from an insulated wire factory, this armature was affected by infiltration of grit and carbon dust through the commutator spider, which caused a considerable deposit of foreign matter under the coils, where they are connected to the commutator. In making repairs, each lead was given additional wrap-

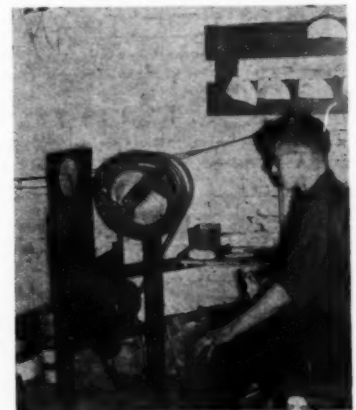


**LONGER LIFE** — Added insulation precautions for armatures used in grit and carbon dust, prevents frequent breakdowns.

pings of linen tape, and the mica extended  $\frac{1}{4}$ -in. beyond the commutator risers, to form a further insulating barrier between coil leads of opposite polarity. About ten typical armatures have recently been reconditioned in this way for this customer.

## COIL WINDER

Aluminum coil forms used at the "Ermco" motor repair shop in Chicago, are mounted on a calibrated holder which allows adjustment for any size coil desired. Seven sets of forms meet



**INTERCHANGEABLE** Winding forms on a calibrated holder permits a wide variety of small motor coils to be made up in quick succession.

the requirements for making up coils for any make or type of small refrigeration motors.

The large volume of small motor business allows the shop to make up and stock complete coil sets. The winder is driven by a single phase  $\frac{1}{4}$ -hp vari-



## PANTHER *and* DRAGON TAPES

1. First to be Wrapped and SEALED in Cellophane.
2. Perfect Adhesiveness and Tensile Strength.
3. Strong Distinctive Green Core.
4. Colorful Attractive Boxes.
5. A Company in the Insulation Business Since 1878.

### HAZARD INSULATED WIRE WORKS

DIVISION OF  
WILKES-BARRE



THE OKONITE CO  
PENNSYLVANIA

WE STILL MAINTAIN OUR ORIGINAL POLICY OF SELLING THESE TAPES THROUGH LEGITIMATE WHOLESALERS ONLY

# MODERN

*Built to meet to-day's  
requirements...*



Type CFT, three-phase, outdoor type, air-cooled transformer.

CONSIDER the economy and convenience of AmerTran Type "CF" Air-Cooled Transformers whenever it is desired to obtain low-voltage power from higher voltage circuits. These moderately priced units are available in sizes up to 100 Kva. and for potentials up to 600 volts. They may be installed wherever they are needed—either indoors or outdoors\*—without the necessity of oil, fire-proof vaults or enclosures. They are also

equipped with either conduit fittings or a built-in junction box to facilitate installation, and both single-phase and polyphase types are furnished as a single unit. These features mean low first cost and minimum installation and maintenance expense. May we send data on equipment to meet your needs?

\* Units 15 Kva. and larger for indoor service only.

## Type "CF" Applications

1. Stepping down power circuit voltage to 115/230 volts for lights, small motors or heating elements. In this way advantage may be taken of lower power rates for low-voltage loads.
2. Obtaining a 3-wire circuit from a 2-wire system.
3. Changing from 3 phase to 2 phase, or vice versa, on a power system.
4. Obtaining low voltage for heating welding, 32-volt tools, special lighting, testing, etc.
5. Balancing load on 3-phase systems.
6. Insulating one circuit from another.
7. Distributing power at 600 volts or less.
8. Reducing light flicker.
9. Obtaining special voltages to permit efficient operation of equipment.

## AMERICAN TRANSFORMER COMPANY

178 Emmet St., Newark, N. J.

# AMERTRAN

Manufactured  
Since 1901  
at Newark, N. J.

# TRANSFORMERS



Type CF, single-phase, indoor type, air-cooled transformer.

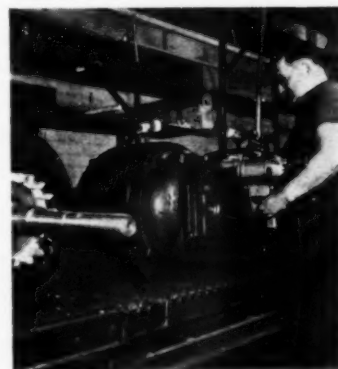
*Motor Shops*

[FROM PAGE 32]

able speed motor, belted to the winding head. A foot treadle controls the operation and the speed of the motor.

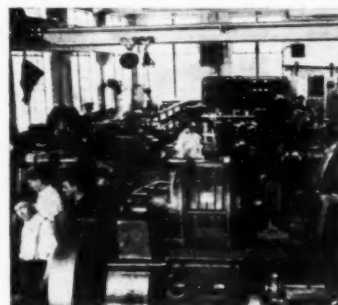
## POWERIZED ASSEMBLY

Power tools sock cap screws home for end frames, when a.c. motors reach the assembly station at the new Westinghouse motor aisle. Motors are brought to this station on waist-high



GRUNTLESS ASSEMBLY — Waist-high conveyor and turntable for operating power driver in a.c. assembling.

gravity-roll conveyors. Actual assembly takes place on a turntable section of the conveyor. Here the operator has a handy stock of bolts and special tools for this operation. His heavy electric driver hangs by a coil spring to ease the job of getting a correct working position.



BUSY DAYS — Canadian mills and other heavy industries have been responsible for this compact large-motor shop in the plant of the Montreal Armature Works, Ltd. Here the big fellows get a thorough reconditioning, with everything in the way of modern equipment available for doing the job. Four engineers are kept busy on outside problems, as feeders for the shop crews.

Electrical Contracting, April 1938

# THIS MODERN PLANT HAS *Lights and Tools on Wheels*

...and A FLEXIBLE POWER DISTRIBUTION SYSTEM

WITH BULL DOG  
UNIVERSAL

**Trol-E-Duct** AND BUS**TRIBUTION**

UNIVERSAL TROL-E-DUCT FOR  
LIGHTS AND PORTABLE TOOLS

BUS**TRIBUTION**  
THE FLEXIBLE PLUG-IN  
POWER DISTRIBUTION  
SYSTEM

MOVABLE  
TROLLEY

LUMINAIRE wired through  
outlet box to Movable Trolley in-  
serted in Duct.

Cross sectional view of MOVABLE  
TROLLEY inserted in Duct.

Cross sectional view of semi-fixed  
TWISTOUT PLUG inserted in  
Duct.

FORMED STEEL DUCT  
COPPER BUSBAR  
INSULATION  
DUCT OPENING  
Trolley Wheels    Actuating Cam  
Current Collectors    Contact Arms  
Guide Rollers    Contact Base  
Trolley Housing    Bakelite Cup

Every inch of Bull Dog UNIVERSAL TROL-E-DUCT is a potential electrical outlet or source of current for lights, portable tools and other electrical appliances. By the use of Trolleys these various electrical devices may be moved anywhere along the Duct run or by using Twist-out Plugs, the devices may be "plugged in" at any point in the Duct, thus creating a semi-fixed outlet wherever desired.

Bull Dog BUS**TRIBUTION** is a flexible Power Distributing System, consisting of Busbars enclosed in a metallic Duct having crescent-shaped panels or outlets, through which Branch Circuit Devices can be "plugged in" to the Busbars at the most convenient point to the motor or machine they protect. These Branch Circuit Devices or "Plugs" are readily removable to meet changes in Plant or Department layouts.

*\*Send for Bulletin Describing These Modern Systems of Electrical Distribution*



**BULL DOG ELECTRIC PRODUCTS COMPANY**

*Pioneers of Flexible Electrical Distribution Systems*

**DETROIT, MICHIGAN**

BULL DOG ELECTRIC PRODUCTS OF CANADA, LTD., TORONTO, ONT.



Sight-Craft Luminaires win the approval of prospective customers . . . and win more sales for the contractor!

Designed by architects and Smoot-Holman lighting engineers, the Luminaires are beautiful in appearance and provide more light . . . properly distributed light . . . balanced light. First costs are low and maintenance costs are rock-bottom. You'll win more sales with Sight-Craft!



**BUILDING MANAGERS say . . .**  
"Smoot-Holman Sight-Craft Luminaires have brought me many new tenants. Office efficiency is stepped up 20 per cent by providing better light with no glare or shadows."

**THE MANUFACTURER says . . .**

"Sight-Craft Reflectors give correct light distribution in my factory, with plenty of light where it's needed most. Maintenance costs are low . . . vitreous porcelain enamel is durable and easy to clean."



**THE CONTRACTOR says . . .**

"Smoot-Holman Equipment is the most profitable line I've ever handled. The fixtures are right in design and construction. Priced right, too . . . helps me win my share of contracts."



SEND COUPON FOR 1938 CATALOGUE

Smoot-Holman Co.  
33 Dore Street, San Francisco

Please send your new Catalog C-48 to:

Name.....

Street.....

City..... State.....

My Supply House.....



## This Matter of Varnish

[FROM PAGE 18]

pate the heat transferred from preheated coils. If too small a quantity of varnish is used, there will be a marked change in viscosity after a few hours use.

In most cases, quantity purchasing of insulating varnish does not cause any spoilage. If kept properly sealed, most varnishes will keep indefinitely, except certain synthetic gum base varnishes, that are unstable and should only be purchased as needed for immediate requirements. Some pigmented red insulating enamels also tend to settle after continued storage, but can be restored to their original condition by stirring.

All storage containers, whether tanks or drums, should be kept tightly covered. Storage containers should also be emptied and cleaned at regular intervals, and the varnish filtered before it is returned to the container.

Insulating varnish is usually supplied at a consistency suitable for use without dilution. The solvents of most varnishes evaporate, however, by exposure, also when preheated coils or stators

An ideal plan is to fill the tank to a predetermined level with new varnish. As the varnish is used the level will drop. The gravity should be checked, the correct amount of thinner added, and the tank filled to its original level with fresh varnish.

For the correct baking of varnish-treated units, a separate schedule must be worked out for each type of work. Here are a few general principles that govern correct baking procedure—

1. Prebake units at about 180° F. for two hours before raising oven temperature to the specified degree. This will insure (a) complete removal of the solvent and (b) prevent trapping of varnish solvents inside the coil. Trapped solvents will never dry, and they manifest their presence by corrosion of wires, throwout at high speeds, or electrical breakdown.

2. Provide adequate oven ventilation to carry off vaporized solvents.

3. Solvent vapors remaining in baking chamber will "wash down" treated units.

4. Vapor accumulations in baking chamber also constitute a serious fire and explosion hazard.

5. Do not extend baking time unnecessarily. Prolonged bakes decrease varnish life and produce a brittle finish.

6. Excessive temperature darkens the color of clear baking varnish.

7. Most repair shops use 240 deg. F. baking temperatures, which manufacturers recommend for standard baking varnishes.

### Observed Specific Gravity

Desired Specific Gravity

DEC	0.903	0.907	0.910	0.913	0.916	0.919	0.922	0.925	0.928	0.931	0.934	0.937	0.940	0.943	0.946	0.949	0.952	0.955	0.958	0.961	0.964	0.967	0.970	0.973	0.976	0.979	0.982	0.985	0.988	0.991	0.994	0.997	1.000	1.003	1.006	1.009	1.012	1.015	1.018	1.021	1.024	1.027	1.030	1.033	1.036	1.039	1.042	1.045	1.048	1.051	1.054	1.057	1.060	1.063	1.066	1.069	1.072	1.075	1.078	1.081	1.084	1.087	1.090	1.093	1.096	1.099	1.102	1.105	1.108	1.111	1.114	1.117	1.120	1.123	1.126	1.129	1.132	1.135	1.138	1.141	1.144	1.147	1.150	1.153	1.156	1.159	1.162	1.165	1.168	1.171	1.174	1.177	1.180	1.183	1.186	1.189	1.192	1.195	1.198	1.201	1.204	1.207	1.210	1.213	1.216	1.219	1.222	1.225	1.228	1.231	1.234	1.237	1.240	1.243	1.246	1.249	1.252	1.255	1.258	1.261	1.264	1.267	1.270	1.273	1.276	1.279	1.282	1.285	1.288	1.291	1.294	1.297	1.300	1.303	1.306	1.309	1.312	1.315	1.318	1.321	1.324	1.327	1.330	1.333	1.336	1.339	1.342	1.345	1.348	1.351	1.354	1.357	1.360	1.363	1.366	1.369	1.372	1.375	1.378	1.381	1.384	1.387	1.390	1.393	1.396	1.399	1.402	1.405	1.408	1.411	1.414	1.417	1.420	1.423	1.426	1.429	1.432	1.435	1.438	1.441	1.444	1.447	1.450	1.453	1.456	1.459	1.462	1.465	1.468	1.471	1.474	1.477	1.480	1.483	1.486	1.489	1.492	1.495	1.498	1.501	1.504	1.507	1.510	1.513	1.516	1.519	1.522	1.525	1.528	1.531	1.534	1.537	1.540	1.543	1.546	1.549	1.552	1.555	1.558	1.561	1.564	1.567	1.570	1.573	1.576	1.579	1.582	1.585	1.588	1.591	1.594	1.597	1.600	1.603	1.606	1.609	1.612	1.615	1.618	1.621	1.624	1.627	1.630	1.633	1.636	1.639	1.642	1.645	1.648	1.651	1.654	1.657	1.660	1.663	1.666	1.669	1.672	1.675	1.678	1.681	1.684	1.687	1.690	1.693	1.696	1.699	1.702	1.705	1.708	1.711	1.714	1.717	1.720	1.723	1.726	1.729	1.732	1.735	1.738	1.741	1.744	1.747	1.750	1.753	1.756	1.759	1.762	1.765	1.768	1.771	1.774	1.777	1.780	1.783	1.786	1.789	1.792	1.795	1.798	1.801	1.804	1.807	1.810	1.813	1.816	1.819	1.822	1.825	1.828	1.831	1.834	1.837	1.840	1.843	1.846	1.849	1.852	1.855	1.858	1.861	1.864	1.867	1.870	1.873	1.876	1.879	1.882	1.885	1.888	1.891	1.894	1.897	1.900	1.903	1.906	1.909	1.912	1.915	1.918	1.921	1.924	1.927	1.930	1.933	1.936	1.939	1.942	1.945	1.948	1.951	1.954	1.957	1.960	1.963	1.966	1.969	1.972	1.975	1.978	1.981	1.984	1.987	1.990	1.993	1.996	1.999	2.002	2.005	2.008	2.011	2.014	2.017	2.020	2.023	2.026	2.029	2.032	2.035	2.038	2.041	2.044	2.047	2.050	2.053	2.056	2.059	2.062	2.065	2.068	2.071	2.074	2.077	2.080	2.083	2.086	2.089	2.092	2.095	2.098	2.101	2.104	2.107	2.110	2.113	2.116	2.119	2.122	2.125	2.128	2.131	2.134	2.137	2.140	2.143	2.146	2.149	2.152	2.155	2.158	2.161	2.164	2.167	2.170	2.173	2.176	2.179	2.182	2.185	2.188	2.191	2.194	2.197	2.200	2.203	2.206	2.209	2.212	2.215	2.218	2.221	2.224	2.227	2.230	2.233	2.236	2.239	2.242	2.245	2.248	2.251	2.254	2.257	2.260	2.263	2.266	2.269	2.272	2.275	2.278	2.281	2.284	2.287	2.290	2.293	2.296	2.299	2.302	2.305	2.308	2.311	2.314	2.317	2.320	2.323	2.326	2.329	2.332	2.335	2.338	2.341	2.344	2.347	2.350	2.353	2.356	2.359	2.362	2.365	2.368	2.371	2.374	2.377	2.380	2.383	2.386	2.389	2.392	2.395	2.398	2.401	2.404	2.407	2.410	2.413	2.416	2.419	2.422	2.425	2.428	2.431	2.434	2.437	2.440	2.443	2.446	2.449	2.452	2.455	2.458	2.461	2.464	2.467	2.470	2.473	2.476	2.479	2.482	2.485	2.488	2.491	2.494	2.497	2.500	2.503	2.506	2.509	2.512	2.515	2.518	2.521	2.524	2.527	2.530	2.533	2.536	2.539	2.542	2.545	2.548	2.551	2.554	2.557	2.560	2.563	2.566	2.569	2.572	2.575	2.578	2.581	2.584	2.587	2.590	2.593	2.596	2.599	2.602	2.605	2.608	2.611	2.614	2.617	2.620	2.623	2.626	2.629	2.632	2.635	2.638	2.641	2.644	2.647	2.650	2.653	2.656	2.659	2.662	2.665	2.668	2.671	2.674	2.677	2.680	2.683	2.686	2.689	2.692	2.695	2.698	2.701	2.704	2.707	2.710	2.713	2.716	2.719	2.722	2.725	2.728	2.731	2.734	2.737	2.740	2.743	2.746	2.749	2.752	2.755	2.758	2.761	2.764	2.767	2.770	2.773	2.776	2.779	2.782	2.785	2.788	2.791	2.794	2.797	2.800	2.803	2.806	2.809	2.812	2.815	2.818	2.821	2.824	2.827	2.830	2.833	2.836	2.839	2.842	2.845	2.848	2.851	2.854	2.857	2.860	2.863	2.866	2.869	2.872	2.875	2.878	2.881	2.884	2.887	2.890	2.893	2.896	2.899	2.902	2.905	2.908	2.911	2.914	2.917	2.920	2.923	2.926	2.929	2.932	2.935	2.938	2.941	2.944	2.947	2.950	2.953	2.956	2.959	2.962	2.965	2.968	2.971	2.974	2.977	2.980	2.983	2.986	2.989	2.992	2.995	2.998	3.001	3.004	3.007	3.010	3.013	3.016	3.019	3.022	3.025	3.028	3.031	3.034	3.037	3.040	3.043	3.046	3.049	3.052	3.055	3.058	3.061	3.064	3.067	3.070	3.073	3.076	3.079	3.082	3.085	3.088	3.091	3.094	3.097	3.100	3.103	3.106	3.109	3.112	3.115	3.118	3.121	3.124	3.127	3.130	3.133	3.136	3.139	3.142	3.145	3.148	3.151	3.154	3.157	3.160	3.163	3.166	3.169	3.172	3.175	3.178	3.181	3.184	3.187	3.190	3.193	3.196	3.199	3.202	3.205	3.208	3.211	3.214	3.217	3.220	3.223	3.226	3.229	3.232	3.235	3.238	3.241	3.244	3.247	3.250	3.253	3.256	3.259	3.262	3.265	3.268	3.271	3.274	3.277	3.280	3.283	3.286	3.289	3.292	3.295	3.298	3.301	3.304	3.307	3.310	3.313	3.316	3.319	3.322	3.325	3.328	3.331	3.334	3.337	3.340	3.343	3.346	3.349	3.352	3.355	3.358	3.361	3.364	3.367	3.370	3.373	3.376	3.379	3.382	3.385	3.388	3.391	3.394	3.397	3.400	3.403	3.406	3.409	3.412	3.415	3.418	3.421	3.424	3.427	3.430	3.433	3.436	3.439	3.442	3.445	3.448	3.451	3.454	3.457	3.460	3.463	3.466	3.469	3.472	3.475	3.478	3.481	3.484	3.487	3.490	3.493	3.496	3.499	3.502	3.505	3.508	3.511	3.514	3.517	3.520	3.523	3.526	3.529	3.532	3.535	3.538	3.541	3.544	3.547	3.550	3.553	3.556	3.559	3.562	3.565	3.568	3.571	3.574	3.577	3.580	3.583	3.586	3.589	3.592	3.595	3.598	3.601	3.604	3.607	3.610	3.613	3.616	3.619	3.622	3.625	3.628	3.631	3.634	3.637	3.640	3.643	3.646	3.649	3.652	3.655	3.658	3.661	3.664	3.667	3.670	3.673	3.676	3.679	3.682	3.685	3.688	3.691	3.694	3.697	3.700	3.703	3.706	3.709	3.712	3.715	3.718	3.721	3.724	3.727	3.730	3.733	3.736	3.739	3.742	3.745	3.748	3.751	3.754	3.757	3.760	3.763	3.766	3.769	3.772	3.775	3.778	3.781	3.784	3.787	3.790	3.793	3.796	3.799	3.802	3.805	3.808	3.811	3.814	3.817	3.820	3.823	3.826	3.829	3.832	3.835	3.838	3.841	3.844	3.847	3.850	3.853	3.856	3.859	3.862	3.865	3.868	3.871	3.874	3.877	3.880	3.883	3.886	3.889	3.892	3.895	3.898	3.901	3.904	3.907	3.910	3.913	3.916	3.919	3.922	3.925	3.928	3.931	3.934	3.937	3.940	3.943	3.946	3.949	3.952	3.955	3.958	3.961	3.964	3.967	3.970	3.973	3.976	3.979	3.982	3.985	3.988	3.991	3.994	3.997	4.000	4.003	4.006	4.009	4.012	4.015	4.018	4.021	4.024	4.027	4.030	4.033	4.036	4.039	4.042	4.045	4.048	4.051	4.054	4.057	4.060	4.063	4.066	4.069	4.072	4.075	4.078	4.081	4.084	4.087	4.090	4.093	4.096	4.099	4.102	4.105	4.108	4.111	4.114	4.117	4.120	4.123	4.126	4.129	4.132	4.135	4.138	4.141	4.144	4.147	4.150	4.153	4.156	4.159	4.162	4.165	4.168	4.171	4.174	4.177	4.180	4.183	4.186	4.189	4.192	4.195	4.198	4.201	4.204	4.207	4.210	4.213	4.216	4.219	4.222	4.225	4.228	4.231	4.234	4.237	4.240	4.243	4.246	4.249	4.252	4.255	4.258	4.261	4.264	4.267	4.270	4.273	4.276	4.279	4.282	4.285	4.288	4.291	4.294	4.297	4.300	4.303	4.306	4.309	4.312	4.315	4.318	4.321	4.324	4.327	4.330	4.333	4.336	4.339	4.342	4.345	4.348	4.351	4.354	4.357	4.360	4.363	4.366	4.369	4.372	4.375	4.378	4.381	4.384	4.387	4.390	4.393	4.396	4.399	4.402	4.405	4.408	4.411	4.414	4.417	4.420	4.423	4.426	4.429	4.432	4.435	4.438	4.441	4.444	4.447	4.450	4.453	4.456	4.459	4.462	4.465	4.468	4.471	4.474	4.477	4.480	4.483	4.486	4.489	4.492	4.495	4.498	4.501	4.504	4.507	4.510	4.513	4.516	4.519	4.522	4.525	4.528	4.531	4.534	4.537	4.540	4.543	4.546	4.549	4.552	4.555	4.558	4.561	4.564	4.567	4.570	4.573	4.576	4.579	4.582	4.585	4.588	4.591	4.594	4.5
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WESTINGHOUSE  
NOFUZE "DE-ION"  
CIRCUIT BREAKER

WESTINGHOUSE  
"DE-ION"  
LINESTARTER

WESTINGHOUSE  
"DE-ION"  
COMBINATION  
LINESTARTER



# "MERGED"

*for Economy in Your Plant*



## WHAT "DE-ION" MEANS



THE OLD WAY



THE "DE-ION" WAY

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## Range Roundup

Electric ranges are so important to Clark & Mills Electric Co. of Boston that all its employees receive instruction on such phases as their use, superiority, construction, installation and performance. A series of morning meetings were held this year to which specialists were invited as speakers on these subjects. So the range is really understood throughout Clark & Mills organization.



**HARRISBURG LAMP MAN**—Taking pride in having every conceivable type of lamp bulb in stock holds customers for Blumenstine Electric in Harrisburg, Pa. E. Blumenstine is a veteran of the industry, and in recent years has specialized in residential service and alteration work. It ties in well with his large display of fixtures, lamps and appliances. Mr. Blumenstine claims to have been the first to make rosin core solder.

## Case Study

Stream-lined management can often pull a floundering business out of what seemed a hopeless failure. L. M. Nichols, of the General Electric Supply Corp., Bridgeport, before the Essex Electrical League of Newark, cited a case of one mid-western contractor's operations. In 1931, this firm's billings were \$240,000 for wiring, motor repairs, sign work and general sales. But only \$60,000 gross was realized to defray a top-heavy overhead that was living off an invested capitalization of \$50,000. A brave reorganization of the business, and less expensive quarters, made this company's 1934 volume of \$179,000 yield \$50,000 gross. Of this amount \$41,500 went for general salaries and other operating expenses, leaving a fair return on the investment.

## Chisellers Beware

Labor cannot be sub-let in the Province of Quebec, Canada, without the principal contractor remaining liable for paying for the actual number of hours required, and at the prevailing minimum wage. Thus no chiselling to beat the minimum wage laws. According to C. Say of the Say Electric Co., Montreal, a workman's claim for additional wages would also include a 25 per cent overhead charge for settling the claim.

## Edison Job to Eddie

To the E. J. White Co. of Newark, N. J., goes the distinction of making the electrical installation for the Thomas A. Edison Memorial at Menlo Park. Although Eddie White is too young to claim membership in the Edison Pioneers, he made sure of being in some way identified with the work of this great electrical figure. And Eddie is right now very busy assembling photos of his work, so perhaps we'll get some later on. We are told the job is outstanding, which is as it should be.

## Costly Maintenance

The price of repair service represents mainly time spent travelling to and from the job. The actual replacement of sockets and switches usually takes only a few minutes. The Universal Electric Co. of Washington, D. C., says the principal cause of this expense is poor grade devices being put in originally on chiselled specifications. At A. Barbra's shop the men are taught to explain to customers that they should insist upon having dependable, maintenance-free materials installed, to hold down repair bills.

## Planning Aids

A chart of electrical symbols for architectural plans has been printed on a card to be circulated by the Pacific Coast Electrical Bureau to every architect and builder in the state of California. Similar distribution will be made as a follow-up with the revised "Red Seal" Wiring Standards, as soon as these are off the press. The standard symbols have been prepared by a technical subcommittee of the American Standards Association and submitted for approval as an American standard to supplement previous symbols approved in 1924.

## Employee Mileage

The Roland Electrical Co. of Baltimore, operates its call service by city zones. These zone limits are used for basing its mileage allowances to employees who drive their own cars on calls. Since most modern pleasure cars have liberal trunk space, small motors or armatures can often be handled also. The company provides an additional haulage allowance to the employee, which is billed to the customer.

### Slow-heat Test

E. C. Carlson of Youngstown, Ohio offers a practical suggestion to residential contractors, who plan to go in for home re-wiring. They should give a demonstration of slow heating in appliances because of overloaded circuits. All that is needed—a long piece of No. 10 or No. 8 flexible cord with clips on one end and a convenience outlet at the other. Connect to the service, plug in toaster or waffle iron on the dinnette table and compare notes with the slow heating normally obtained.

### Motors Galore

Modern processing machinery is piling on motors until they are almost as thick as fleas on old Tighe. Just now Chewning and Wimer, Inc., are wiring a new cigarette manufacturing plant in Richmond, Va., which has one machine that is supposed to have seventeen motors hidden away among its levers, cams and gear boxes.



**LIKES HEAVY JOBS**—Providence, R. I. has had some tough power plant jobs include two 1250 kw turbine units had the Coken Company's shingle on several of them. Recently completed jobs going on, and Irving Coken has in the city's new incinerator plant, a 937 kva unit at the state institution power plant, and a 500 kva unit for a local industrial customer.

### "Price Cutters"

Dave Moore of Windsor, at the recent convention of the Ontario Electrical Contractors Association, distributed some new thought on an old subject. It was a card. It read—

"My Son, never speak unkindly of price-cutters, never knock them because God made them the same as He made crabs, hornets, roaches, lizards, ants, centipedes, fleas, lice, bugs, wasps, snakes, skunks and other unpleasant things. In His inscrutable wisdom He made them. Why He made them only He knows. Some day He may enlighten us . . . but up to now . . . I'll be damned if I understand."

*Electrical Contracting, April 1938*

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## WHAT YOU NEED TO KNOW

A MAN'S head seems to hold about so much. You keep cramming in new knowledge all the time and other facts you need to know keep slipping away from you.

This series of "Guide Sheets" is presented as a simple "Check-up of Maintenance Practice." It is a review of the background knowledge needed by the electrical maintenance man on electrical apparatus for which he is responsible—how it operates and why. Read each one of them. It will speed up your solutions to many daily problems.

This "Check-up of Maintenance Practice" began in January with a discussion of the maintenance man's job. Then followed—

1. ALTERNATING CURRENT MOTORS. Types and Applications.
2. DIRECT-CURRENT MOTORS—Uses and Advantages

Future articles will discuss—

4. DIRECT CURRENT MOTORS—Maintenance
5. A.C. MOTOR STARTERS AND CONTROLLERS—Types, Applications and Maintenance
6. D.C. MOTOR STARTERS AND CONTROLLERS—Types, Applications and Maintenance
7. SPECIAL CONTROL PROBLEMS—Heavy Installations and their Maintenance
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17. ELECTRONIC DEVICES—Types and Applications

# Maintenance

## The MAINTENANCE of ALTERNATING CURRENT MOTORS

**K**ee the plant running! In a nutshell, that is the electrical maintenance man's major responsibility. Therefore, as a logical sequence to the two previous articles on motor operation in this series, this chapter reviews the most important aspects of a.c. motor maintenance. The chart on page 43, gives a bird's-eye view of common troubles, listing symptoms, causes, and remedies.

Alternating current motors of about 500-hp. and less of the polyphase synchronous and induction type, and single-phase integral and fractional-horsepower type will be discussed in this article. They are the types most commonly found in industrial plants, commercial and office buildings, power plants, and the like.

The word *maintenance*, as used in this article, refers to the care of a.c. motors, so that they will operate efficiently and continuously. It includes inspection, cleaning, lubrication, testing, replacement of worn parts, overhauling and proper storage of spare parts.

And of course, in a broader sense, maintenance really begins with the selection and installation of the proper type of motor to provide efficient electrical and mechanical operation under a given load condition.

### Electrical Selection

Of special importance electrically is the choice of a motor of ample capacity to start, accelerate and continuously operate the driven equipment. Also, the life of the insulation of an improperly applied motor may be

greatly shortened by damaging temperatures or by atmospheres which are dust- or moisture-, or fume-laden. For example:

1. *Starting Load*.—A normal torque, normal starting-current squirrel-cage motor should not be used on a conveyor which starts loaded. It should be driven by a *high* torque, *low* starting-current squirrel-cage motor.

2. *High Temperature*.—Motors with "Class B" heat-resisting insulation should be used where the surrounding air is at a high temperature.

3. *Dust and Dirt*.—Motors operated in dusty or dirty atmospheres require much less servicing, if they are of the enclosed fan-cooled or enclosed pipe-ventilated type.

### Mechanical Selection

Of special mechanical importance, is the installation and method of drive, the proper choice of couplings, pulley diameters, belt pull and arrangement, motor location and motor support on the foundation. For example—

4. *Location*.—The motor should be easily accessible for maintenance and repair. Enough clearance space should be provided for the removal of the entire motor or its parts.

5. *Foundation*.—Foundations should be heavy and rigid, so as to avoid vibration. If the driven machine has excessive vibration, some method of flexible drive should be used.

6. *Alignment*.—The motor shaft should be carefully leveled. A check should be made of the alignment of



**THEY KEEP 'EM RUNNING**—"Megger" tests are included in the periodic inspection of electrical equipment in the Girard Trust Co. Building, Philadelphia. An engineer of the Hartford Steam Boiler Inspection & Insurance Co. makes a test on a motor-generator set to determine the insulation resistance, and thereby eliminating shut downs from failure of insulation.

the pulley, pinion or coupling, for any mis-alignment may cause excessive load on bearings, pulley, and other parts.

Gears, pulleys and couplings should be located as close as possible to the motor bearing. They should not be driven on or off as this may injure the bearings, especially if of the ball bearing construction.

7. **Belts**—Endless leather belts or the equivalent are recommended. Belt lacing which causes a lump on the belt will pound the motor bearing. It is not good practice to use double ply belts on pulleys less than 8-in. in diameter. Distance between pulley centers should be sufficient to give a good arc of contact, so as to avoid excessive pressure on the bearings. A good rule to follow is to make the belt centers at least five times the sum of the two pulley diameters. If closer belt centers are necessary, the use of V-belts is recommended.

#### Inspection and Servicing

Periodic inspection is essential to insure good operation. Depending upon the severity of operating conditions, at least one motor inspection a week is recommended. A complete cleaning, overhauling and thorough inspection should be made every year.

8. **Cleaning**—Clean motors will give the best service. On the weekly inspections, dirt or dust should be blown out with fairly low-pressure dry compressed air. Where conductive or abrasive ma-

terial might be blown into the air gap or windings, such materials should be removed carefully. In some cases removal can be accomplished more easily by suction. The exterior and readily accessible parts should be cleaned as often as possible.

9. **Lubrication**—Long bearing life may be assured by keeping foreign matter out of the oil reservoir and by maintaining proper belt tension, machine alignment and good lubrication. Lubrication of the three commonly employed bearings—sleeve, ball, and roller types—requires slightly different methods, as outlined below.

a. **Sleeve bearings** require frequent inspection. About every six months the oil reservoir should be flushed out with gasoline or kerosene and refilled with fresh oil. A good grade of oil of about 250 Saybolt at 100 deg. F. can be used for machines having normal journal speeds and bearing pressures.

It is good practice to check the oil level at each inspection, adding oil only when necessary and only when the motor is idle. Usually oil level is maintained  $\frac{1}{4}$ -in. from the top of the cup, and the column of the glass gauge is kept about two-thirds full. In addition, the oil rings should be observed to see if they are in normal working order.

When a bearing shows signs of undue heating, say in excess of 65 to 75 deg. C., compressed air or a fan may be used for cooling until the trouble can be corrected. A very slight loosening

of the bearing cap and, if possible, a reduction of the load may be helpful. To prevent "freezing," the shaft should be kept turning until the bearing has cooled to some extent.

Bearings which are worn and have too much clearance may affect the air gap. An unequal air gap increases losses in the motor and sets up an unbalanced pull which may result in severe vibration or noise. Temporary equalization of the gap may be accomplished by means of jack screws provided on the bracket bearings of some machines. In case of excessive bearing clearances, the bearings should be rebabbitted or replaced.

b. **Ball and roller bearings** are usually supplied with sufficient grease for one year's service, based on an 8-hour day operation for most applications. On periodic inspections, it should be determined that grease has not been forced out of the bearings.

Once a year the grease should be removed and the bearing repacked with fresh grease. The grease can be removed with gasoline and kerosene, using rags free of lint or threads. Carbon tetrachloride is good for flushing, because it is a ready solvent of caked grease, but it should always be followed with a flushing oil.

A list of approved greases can be obtained from the motor manufacturer. The grease must not contain graphite and must be chemically neutral. The main purpose of the grease is to protect the polished steel parts from corrosion and not to reduce friction.

Ball bearings require only a small amount of grease. The bearing chamber should not be more than half filled with grease. Too much grease increases friction, causes the bearing to heat, and the excess works out along the shaft. *Any appearance of oil or grease along the shaft exterior to the bearing should be promptly investigated.*

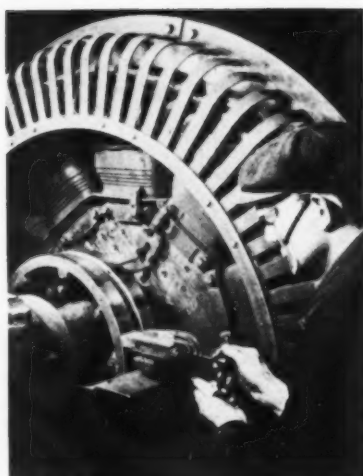
10. **Brushes and Rings**—It is essential, in replacing worn brushes, that one of the same grade or trade designation be used. If this is not done there will be unequal division of current between brushes of different quality. There also may be considerable wearing of the slip rings and commutator.

Brushes should be provided with an even and firm pressure, and should not bind in their holders. Pressure will depend on the grade or quality of brush used. The proper spring tension is set at the factory and should be maintained.

In fitting the brushes, coarse sandpaper may be used first and the final fit made with fine sand paper, with a light pressure on the brush applied by the brush spring. The sandpaper is to be drawn in the direction of rotation and

# TROUBLE CORRECTION CHART FOR A. C. MOTORS

SYMPTOM	CAUSE	REMEDY	SYMPTOM	CAUSE	REMEDY
Motor does not start	Improper application	Alter motor design or type. Consult manufacturer	Motor overheats during operation (cont'd)	Badly unbalanced terminal voltages	Check for faulty lines, leads, connections, transformers
	Apparatus not unloaded as it should be	Check driven equipment to reduce load		Fans reversed or wrong rotation	Change fans or rotation
	Line voltage drop excessive. Voltage down at terminals	Either increase voltage at motor or reduce load torque		Shorted stator coil	Test with wattmeter and repair
	No voltage at motor	Renew fuses. Adjust relay switch, starter, push-button		Ground	Locate with test lamp and repair
	Improper wound rotor secondary resistance	Check control for condition of grids, relays, etc.		Poor connections	Check for high resistance
Motor hums but does not start	Improper rotor starting resistance (synchronous)	Check for open field, shorted, broken or incorrect resistor	Motor vibrates after repairs have been made	Voltage too high	Check with voltmeter, lower or raise voltage
	Single phase voltage applied (poly-phase motors)	Check leads and connections for open lines		Voltage too low	Worn bearings, replace
	Overload	Remove cause. Lighten load		Rotor rubs on stator	Realign
	Open rotor bar	Look for broken bar		Misalignment of set up	Make foundation solid
	Open stator coil	Locate with test lamp and repair		Foundation insecure	Balance coupling
Motor starts and then stops	Power failure	Check load, fuses, overload relay, control	Bearings overheat (S = Sleeve) (B = Ball)	Coupling out of balance	Rebalance driven equipment
	Improper application	Alter motor design or type. Consult manufacturer		Balance of driven equipment changed	Replace bearing
	Line voltage drop excessive	Increase voltage if possible. Reduce load if possible		Broken ball in bearing	Line up
	Improper relay operation of secondary resistances	Correct relay operation		Bearing out of line	Necessary to rebalance rotor
	Apparatus not unloaded during starting	Check driven equipment, with view to unloading		Fans or weights shifted, holes drilled	Check leads and connections for open lines
Motor does not come up to speed	Insufficient pull-in torque of synchronous motor	Adjust rotor starting resistance. Alter motor design	Unequal line current in polyphase motors during normal operation	New rotor coils installed	Adjust bearing or add washer
	Brushes left off one ring of wound rotor motor	Check rotor connections and correct conditions		Single phase operation of poly-phase motor	Check and replenish oil or grease
	Single-phase operation of poly-phase motor	Check lines and connections for open leads		Too much end play	Check for proper amount
	Open rotor bar	Look for broken bar, repair or replace rotor		(S & B) Lack of lubrication	Repair or renew rings
	Open stator coil	Locate with test lamp and repair		(S & B) Too much grease	Replace bearing
Motor takes too long to come up to speed	Overload	Remove some load	Stator coils too hot	(S & B) Broken ball in bearing	Loosen belt and reduce load if necessary
	Poor connections	Check for high resistance		(S & B) Too much belt tension	Reduce thrust from driven apparatus
	Defective squirrel cage rotor	Replace rotor		(S & B) End thrust	Realign
	Reversed phases	Reverse connections of motor leads		(S & B) Misalignment	Line up or replace
	Motor starts in opposite direction (polyphase motor)	Check connections at switchboard, transformers or elsewhere		(S & B) Bearing out of line	Check leads, connections
Motor overheats during operation	Overload	Reduce load. Supply external blowers	Scraping noise	Unequal terminal voltage	Check lines, connections for open leads
	Dirty motor	Use motor with greater capacity		Single phase operation	Check control and correct
	Single phase operation of polyphase motor	Clean motor, with dry compressed air		Improper contact of rotor resistance control	Check brushes and connections
		Check for open leads or connections		Brushes of one ring of wound rotor not in place	Reduce load
				Overload	Test with wattmeter and repair
Motor starts in opposite direction (polyphase motor)	Overload	Reduce load. Supply external blowers	Humming noise	Shorted stator coil	Locate with test lamp and repair
	Dirty motor	Use motor with greater capacity		Ground	Check connections and for high resistance
	Single phase operation of polyphase motor	Clean motor, with dry compressed air		Improper or poor connections	Check with voltmeter and lower or raise voltage
		Check for open leads or connections		Voltage too high or too low	Clear fan
				Fan striking	Line-up motor and tighten bolt
Motor starts in opposite direction (polyphase motor)	Overload	Reduce load. Supply external blowers	Humming noise	Loose on slide rails	Check shaft and bearings
	Dirty motor	Use motor with greater capacity		Airgap not uniform	Test on parallel bars and balance
	Single phase operation of polyphase motor	Clean motor, with dry compressed air		Rotor unbalanced	
		Check for open leads or connections			



**SMOOTH SURFACES** on slip rings of synchronous and induction motors eliminate sparking, pitting, and possibly more serious trouble in operation. Rings become grooved by the continuous friction with the brushes. Usually the most accurate grinding of the rings can be done when the motors are run at normal speed in their own bearings. A "commstone" in a suitable holder can be used for the grinding operation, without removing the slip rings or rotor.

close to the ring or commutator, so as to keep the full arc of contact between the paper and the rings, to avoid rounding of the leading and trailing edges of the brushes.

**11. Heating**—Motor temperature guarantees are based on degrees Centigrade rise above an "ambient" or surrounding temperature of 40 deg. C. If there is any doubt as to the safe operating temperature, it is best to measure, by thermometer, the hottest available part of the motor and surrounding air. Do not depend on the hand to determine the temperature of a motor.

Considerable assurance toward maintaining correct operating temperatures can be had by keeping the motor clean and supplied with good clean cooling air.

Overloaded motors have high temperatures, which reduce the insulation life. Ordinarily, open motors are insulated with "Class A" insulation, which will begin to roast when a temperature of 95 deg. C. is maintained. Any condition which produces flame, smoke, or even a pronounced odor should be immediately investigated.

**12. Vibration**—Single-phase operation of polyphase motors, too much bearing clearance, uneven air gap condition, bent shaft and poor motor alignment, are frequent causes of vibration and require correcting.

In direct-connected machines, vibration may be transmitted from the driven machine to the motor. In extreme cases the motor brushes may vibrate and

greatly affect motor operation. Or the rotor might rub on the stator, short-circuiting the laminated punchings and causing local hot spots. Machine vibration, therefore, should not be allowed to continue. Serious consequences may result.

#### Overhauling and Repair

Since overhauling and repair usually take place when the motor is out of service, a thorough investigation of the various parts, not accessible during operation, should be made at that time. Accumulations of oil and dirt should be removed from the windings by means of a suitable cleaning agent. At the same time the winding should be checked for deterioration or other troubles. It should then be coated with air drying varnish applied with a spray gun.

**13. Painting**—If the motor is to be repainted, care should be taken that the bearing pedestal or bearing housing insulation (used to prevent shaft currents) is not short-circuited. That part of the shaft in the bearings should be checked to note whether any shaft currents may have damaged it. Also, the bearings should be gone over with a view to keeping a proper air gap all around the bore. Other points to be noted are loose core iron, spots on stator or rotor, where rotor may have rubbed or loose lacing of the coil ends.

#### Spare Parts

Spare parts carried in stock are good insurance against expensive shutdowns. Where continuous operation must be maintained, a few spare motors are usually available, which can be quickly substituted in case of motor failure, or to enable necessary repairs to be made before complete failure. Unless rewinding facilities are quickly available, it is good practice to carry in addition, some spare bearings, a one-third set of stator coils with insulating materials for the important ratings of large induction and synchronous motors, a one-third set of rotor coils for slip ring motors and a few field poles with windings for synchronous motors.

#### Drying

Usually, on larger machines, which have been rewound with coils carried in stock for some time, it is best to dry out the winding before putting the machine in operation. This should also be done to machines which have been taken from storage and are applied to a job. The drying out consists of slowly applying heat and driving out the moisture without damaging the insulation of the motor.

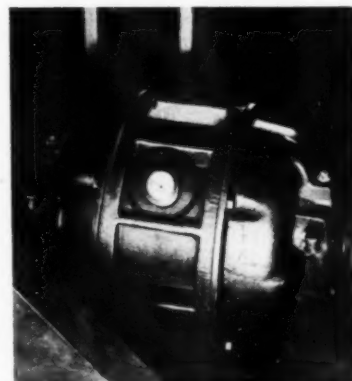
Perhaps the best method of drying out is by circulating current, either a.c. or d.c. through the windings to produce heat inside the insulation and drive the moisture outward. Another method is by heat externally applied. A fan may be used to force air through hot resistors and around the windings, or steam pipes or gas can be used to supply heat. Or it may be best to build an enclosure around the machine and to convey the heat to it by ducts. The enclosure and ducts, of course, should be made of a non-inflammable material. Small motors, coils and armatures of single phase motors can be dried out in ovens.

#### Testing

A suitable megger or ohmmeter, can be used to check the windings. For a clean, dry machine the insulation resistance in megohms at 75 deg. C. is given by the American Standards Association as—

$$\text{Insulation Resistance in Megohms} = \frac{\text{Rated voltage of machine}}{\frac{\text{Rating in KVA}}{100} + 1,000}$$

Although the jurisdiction of the electrical maintenance man ordinarily ends at the motor coupling or pulley, he should also have a good knowledge of power transmission, insofar as the motor bearings may be affected. His responsibility should include the proper placement of safety devices or guards for the electrical equipment. Such devices for protection are ordinarily covered in local, state, or other electrical safety codes with which he, as an electrical maintenance man, should be familiar.



**HOW HOT IS TOO HOT?** Temperature Indicators can be mounted on frames of motors, and on bearings; suitable leads are furnished for an extension to the windings. They facilitate loading and indicate approach to danger zone for over-heating, thereby reducing repair and maintenance costs. "Tel-Temp" thermometers may be used on either open or enclosed motors.

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a Four-Way Saving on

## FLOODLIGHTING

### The 2-in-1 Floodlight BENJAMIN DUO-SERVICE WITH SAFLOX

Here's the money-making story on Benjamin Floodlights that will win new sales and profits for electrical contractors this season. Every service station operator wants to be rid of the expense and the hazard involved in cleaning floodlights from a ladder! He can now do this and make a four-way saving on his floodlighting by installing Benjamin Duo-Service Floodlights with SAFLOX. Here's a story worth bringing to the attention of your every customer and prospect. Here's the message with which Benjamin is paving the way for your calls on prospects. It appears in this monthly magazine advertising directed to Service Station Operators.

"YOU GET REAL MONEY-**SAVING** features when you specify Benjamin Duo-Service Floodlights. You get Duo-Service, the patented Benjamin feature which makes this unit two floodlights in one! A feature that enables you to have one floodlight do the double job of spotlighting the buildings and floodlighting the grounds. That means you need fewer floodlights and have a lower initial cost when you specify Benjamin Duo-Service Floodlights. You save on light bills too because each lamp does double duty in the Duo-Service Floodlight.

"Another exclusive money-saving feature is **SAFLOX**. This new feature enables you to lower the floodlight fixture to the ground for easy cleaning and relamping. The maintenance saving alone will pay for SAFLOX in the first year but there is another and even more important saving. That saving is the money you save by getting all the light you pay for! Dirty reflectors can waste 25% of the light. . . . SAFLOX eliminates the need for this waste by making the cleaning operation so quick, easy and safe that the cleaning cost is practically nil!" Address The Benjamin Electric Mfg. Co., Des Plaines, Ill. Distributed in Canada by The Amalgamated Electric Corporation, Ltd.

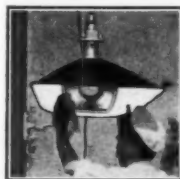
Write today for complete plan to go after and get **MORE SERVICE STATION LIGHTING BUSINESS**. Let Benjamin Duo-Service Floodlights and advertising help you to **MAKE MORE MONEY!**

1 **SAVE ON  
INITIAL  
EXPENSE**  
(Duo-Service)

2 **SAVE ON  
MAINTENANCE  
EXPENSE**  
(Saflox)

3 **SAVE ON  
WASTED  
LIGHT**  
(Saflox)

4 **SAVE ON  
DEPRECIATION  
COST**  
(Porcelain Enamel)



**BENJAMIN**  
**LIGHTING EQUIPMENT**  
Distributed Exclusively Through Electrical Wholesalers

Benjamin Electric Mfg. Co.,  
Des Plaines, Illinois.

PLEASE SEND ME COMPLETE KIT OF ADVERTISING  
MATERIAL ON SERVICE STATION LIGHTING. Also com-  
plete details on Benjamin Floodlight Equipment.

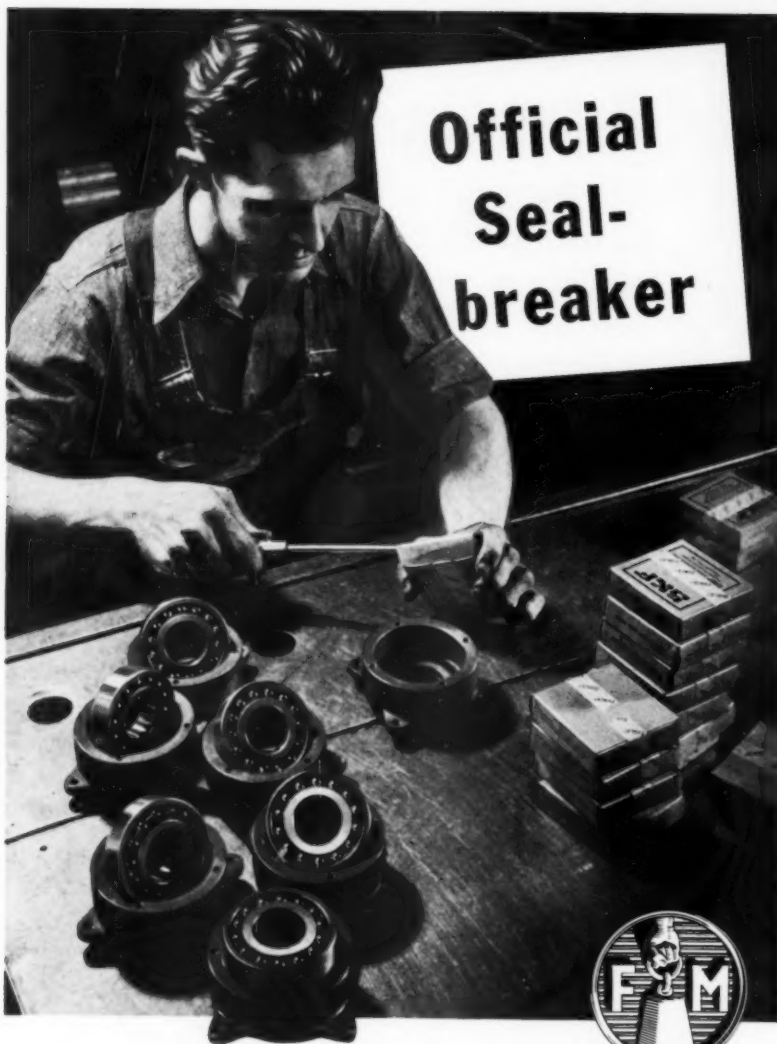


Name \_\_\_\_\_

Address \_\_\_\_\_

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State \_\_\_\_\_



● The highest-priced bearings in the world are used in Fairbanks-Morse motors. Neither dust nor dirt is permitted to compromise their efficiency. Delivered sealed, they remain sealed until the moment an official "seal-breaker" is



When it's even too hot for a Hottentot, COM-FORTIZE with Fairbanks-Morse air conditioners.

ready to install them. Thus, bearings are protected. Thus you are assured of ideal lubrication — greasing is required but once a year. The oil can go out when F-M Ball Bearing Motors come in.

These precautions are typical of F-M precision in every process of motor building. That's why F-M motors serve you long and well.

Fairbanks, Morse & Co., Dept. 24, 600 South Michigan Avenue, Chicago, Ill. 35 branches at your service throughout the United States.

7352-EA40, 139

## FAIRBANKS-MORSE

DIESEL ENGINES  
PUMPS  
ELECTRICAL MACHINERY  
FAIRBANKS SCALES  
RAILROAD EQUIPMENT  
WATER SYSTEMS

REFRIGERATORS  
RADIOS  
WASHERS  
FARM EQUIPMENT  
STOKERS  
AIR CONDITIONERS



# Motors

### Extension Cords For Electric Tools

Occasionally portable electric tools must be used at a distance greater than that permitted by the cable cord furnished with the tool. An extension cord can be used, but the wire should have a diameter large enough so voltage drop will not interfere with the operation of the tool.

Cable cord furnished with electric tools is sufficiently long for most work. The length varies from 6 ft. to 15 ft., and even more. Wodack Electric Tool Corp., Chicago, Ill. has furnished the following table which may be used as a guide to the correct wire to use for long extensions.

Extension in feet	Size of wire
50	No. 12
100	No. 10
200	No. 8

Rubber covered cable used on electric tools is high grade and somewhat expensive. A reduction in the cost of the extensions can be made by using two single-conductor weatherproof wires fitted with weatherproof plug and socket.

### Common Illumination Terms

*One International candle* is the intensity of light from a candle of composition agreed upon, in 1909, by the national standardizing laboratories of France, Great Britain and the United States.

*Candlepower* of a lamp means its light-giving quality expressed in international candles.

*Illumination* is the amount of light per sq. ft. striking a surface. The unit used is the foot-candle.

*One foot-candle* of illumination on a surface means one "lumen" of light per sq. ft. striking that surface.

*Lumen* is the standard unit of quantity of light, and is equal to a certain fraction of the light emitted by an international candle; 12.57 lumens equal one candle power.

The rated candlepower of a source, which emits light uniformly in all directions, divided by the square of the distance between it and the working plane in feet, will give the foot-candle illumination at the working plane. Electric lamps do not emit light uniformly in all directions, so this procedure will give only rough estimates.

*Illumination* as distinguished from *brightness*. The first is a measure of the light striking on a surface; the

# *Neat—but not gaudy!*



## **DEAD FRONT, MULTI-MOTORED, FLOAT CONTROLLED SEWAGE PUMP PANEL**

*Designed by Dept. of Engineering, City of Hartford, Conn., for use in the Avon Street Sewage Pumping Station, constructed for the Bureau of Public Works of the Metropolitan District.*

● Back of these trim compact panels are heavy duty bus bars with rounded ends to guard against skinned knuckles—Edgewound resistors to stand heavy duty—intricate wiring so prim that it looks simple—and motor controls for two main pump slip-ring motors. ● By means of a multi-contact float device, motors oper-

ating pumps at different speeds according to the liquid level are started, and then stopped as the liquid level recedes.

● Entirely automatic in operation—but manual operation is included for emergency service. ● Trim—neat—compact—serviceable controls—these are available through consultation with our nearest office.



### **THE CLARK CONTROLLER CO.**

1146 EAST 152ND STREET • • CLEVELAND, OHIO

**NO OTHER RACEWAY  
FOR WIRING CAN  
GIVE YOU *all*  
THESE FEATURES**

Cold-Rolled Open-Hearth Steel

100% Electric Resistance Weld

Adequate Protection

Light Weight

Easy to Cut

Easy to Bend and Rebend

No Threads

✓ 3 Simple Fittings

Knurled Inside Surface

Uniform Corrosion-Resistance

Easy to Install

Universal Acceptance

Low Cost

Widespread Distribution

Assistance of a Field Force



Knurled inside finish (Patent No. 1,962,876)  
available in 1/2", 3/4" and 1" sizes.

**INSTALL WIRING SYSTEMS THAT**

*Last a*

**PROTECTED AGAINST RUST AND CORROSION  
AT EVERY POINT IN THE SYSTEM**



**ELECTRUNITIS-**

REG. U.S. PAT. OFF.

**MORE THAN 175,000**

# Lifetime

## WITH THIS BETTER RACEWAY FOR WIRING

- ELECTRUNITE Steeltubes resists corrosion—uniformly and positively.

A fine grain structure and a tight-skinned surface, produced by cold working the metal, make the tubing itself resistant to corrosive attack. Added to this is the protection of a coating of pure zinc applied by the most modern electrical method—the only method of galvanizing that can be depended upon to apply a zinc coating of uniform thickness at all points and at all times.

The zinc coating is unusually dense, adherent, tough and pliable. It will not crack, flake or peel under the punishment of severe bending. Since ELECTRUNITE Steeltubes is threadless, there are no cut threads to rust and weaken joints—no damage to the protective zinc coating by pipe wrenches, dies or vises.

Give your customers the best wiring system obtainable for the money—give yourself a break by using this easy-to-install raceway—use ELECTRUNITE Steeltubes.



# Steeltubes

1000 FEET INSTALLED!

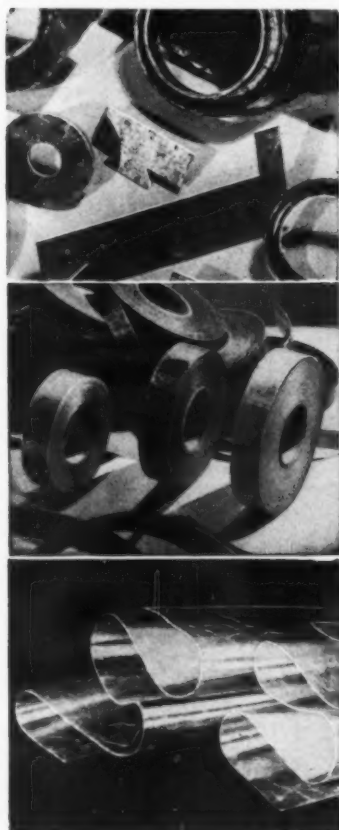
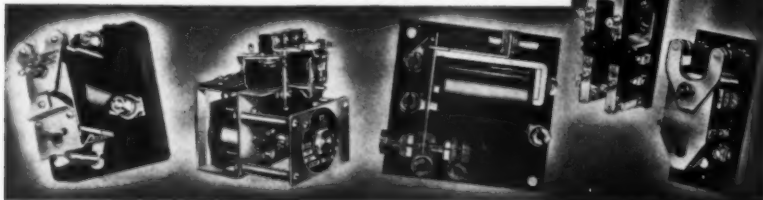


## THESE RELAYS SERVE ALL REMOTE CONTROLS

Probably the greatest advance in design of electrical control equipment has come in the field of relays. Ward Leonard has pioneered this work giving relays that are more desirable, more positive, more sensitive and at the same time that operate with less electrical loss.

*Send for copies of Relay Bulletins to bring your data files up to date on these new and improved relays for your every purpose.*

**WARD LEONARD  
ELECTRIC COMPANY**  
28 South Street, Mount Vernon, N.Y.  
Electric Control Devices Since 1892



## MICABOND

### *Mica in its most usable form*

MICABOND is supplied in various forms of molding plate, segment plate, heater plate, flexible sheets, tapes, tubing and punched or formed parts, such as "V" rings, washers, segments and other special shapes. These forms of MICABOND possess varying characteristics—properties which have been brought out to meet specific insulating needs. In MICABOND plate, there are nine distinct types—each made to fit a particular general application.

For insulating armature coils, turbogenerator coils, and other applications where a flexible insulation of high resistance is required and for emergency repairs in many types of apparatus MICABOND Tapes are efficient and easily handled.

There is a type of flexible MICABOND Sheet for every requirement where pliability without heating is needed. For the making of "V" Rings there is MICABOND Molding Plate which can be readily molded into almost any shape by heating. Upon cooling it becomes rigid and firm. For cutting segments there is a special grade of MICABOND Plate milled to within plus or minus .002" and which will not ooze, slip or otherwise change its shape under heat and pressure.

Send for a copy of the complete MICABOND catalog. You will find it useful.

**CONTINENTAL-DIAMOND  
FIBRE COMPANY**  
NEWARK, DELAWARE

second is a measure of the light reflected by a surface. Brightness, therefore, is a function of the coefficient of reflection of a surface.

*Coefficient of reflection* of a surface is the ratio of the light reflected from a body to that striking upon it.

*Lamp efficiency* is the lumens per watt of electrical power needed by the lighting installation.

*Glare* is the condition existing when a person is required to view objects against bright backgrounds or penetrating light sources.

*Normal field of vision* is considered a 30-deg. cone having the apex at the observer's eye and the axis 15-deg. above the horizon.

## Electric Heat

### Speeds Leather Softening

A tractor manufacturer in the Middle West uses special leather washers as grease seals. These washers are stiff when first made, and if they were installed without softening, they would wear out much faster if any irregularities existed in the machine shafts.

Standard procedure was to soak the washers in oil for 48 hours. This length of time was required, at room temperature, to insure complete penetration of the oil, and was a serious drawback.

To speed up the process, an insulated tank was installed. It is heated by a 2½-kw. immersion heater, thermostatically controlled. The time required for soaking the washers has been reduced from 48 to 2½ hours.

## Getting Rid of

### Elevator-Motor Vibrations

As a part of its elevator modernization program, a large bank building in Roanoke, Va., recently installed two new large motor-generator sets, in a control room on the roof.

At first these units were mounted on cork vibration dampeners, which in turn were attached to 8-inch I-beams, the latter resting on a terrazzo floor. Although the generators ran smoothly enough on these mountings, vibration was being transmitted through the floor to the extent that it could be heard in most parts of the building. This vibration was sufficiently noticeable to annoy the occupants of the offices directly below.

The problem was solved quickly and economically by simply bolting a Goodrich No. 10 Vibro-Insulator to each end

WE MAKE SOME INSTALLATIONS OF VERY

*Large*

POWER PANELS TOO!



Industrial installations of switchboards and power panels such as this one for Trico Products Corporation, Buffalo, N. Y. are not uncommon for us to handle here. This power panel board shown is 60 feet long and controls the production equipment in one department of the Trico plant. Specializing as we do in building switchboards to meet unusual requirements, we have

accumulated in our 40 years of experience a valuable fund of highly specialized engineering knowledge and this is at your disposal. All of our power and lighting panels are built to specifications much higher than those imposed by safety regulations and building codes. Correct design, good engineering, skilled workmanship and the best of materials go into every product bearing our name

*Specification manual will be sent on request*

*Manufacturers of Safety Power and Lighting Panels, Knife Switches, Pull Boxes, Cutout Boxes, Cabinets and Switchboards*

## **THE CLEVELAND** *Switchboard* **» » COMPANY « «**

2927 EAST 79TH STREET • CLEVELAND, OHIO

*Established in 1900—Member N. E. M. A.*

*Branch Offices at Chicago, Detroit, Indianapolis, Buffalo, Dayton, Pittsburgh, Philadelphia, Baltimore, Birmingham*

# More and Cleaner Pipe Cuts with the RIGID Cutter

• Your experience with pipe tools makes it easy for you to see at once why this patented

RIGID cutter saves you money on cutter wheels and gives you far cleaner cuts.



For the RIGID wheel has a thin blade coined from special rolled alloy tool steel, hammered and heat-treated to give it extra guts, then assembled in a solid hub. It rolls right through any pipe, quickly, easily, leaving practically no burr. Far more cuts per wheel, saves you bother and expense of replacement.

Cutter housing reinforced, strong and true-cutting. A tool you enjoy owning and using. Hundreds of thousands in use. Try one at your jobber's. For better cutting and economy, buy the RIGID Cutter.

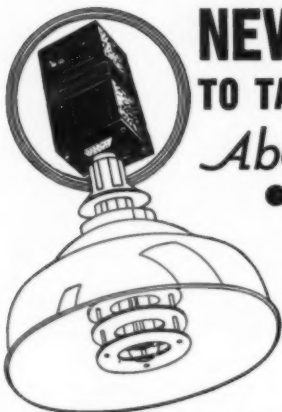
The Ridge Tool Co.

Elyria, Ohio



**RIGID PIPE TOOLS**

## HERE'S Something NEW!! TO TALK About



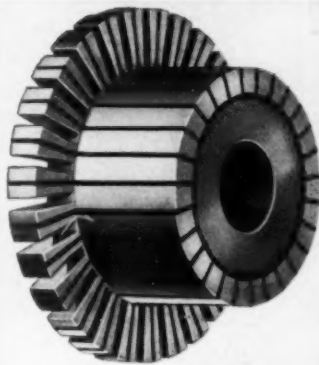
• High Intensity Mercury Vapor Lighting offers new sales opportunities for all lighting contractors interested in big industrial jobs. Big and large plants have found it a profitable improvement, reducing power costs, increasing efficiency and production.

But remember, the most important part of a Mercury Vapor installation is the transformers. They're the "key" to better light and economy. So, be safe and sure; specify and use Acme High Intensity Mercury Vapor Transformers. Write for Bulletin.

**THE ACME ELECTRIC & MFG. CO.**  
36 Water St. Cuba, N. Y.

**Acme Electric**  
TRANSFORMERS

## DROP YOUR COMMUTATOR PROBLEMS IN HOMER'S LAP



Whether a long run of stock commutators for an appliance, or a single commutator for an immense roll mill motor, HOMER gives service that satisfies. Leading manufacturers of motor-driven appliances and motor and generator builders all turn to Homer for commutators built to their specifications and to meet short delivery dates. Special attention is given to "hurry-up" repair jobs. MATERIALS used are highest quality, accurately gaged, and thoroughly inspected, so that smooth running at all speeds is assured. You, too, can depend on Homer to take care of your commutator problems.

**HOMER COMMUTATOR CORP.**  
4747 Hough Avenue, Cleveland, Ohio

of the I-beams, as shown in the illustration. These rubber-to-metal mountings are of the double-shear type. They have a minimum frequency of 1,090 vibra-



VIBRATION not noticeable to occupants of offices after rubber-to-metal insulators were placed at ends of I-beams.

tions per minute and will support a maximum load of 50 lb. per inch.

Since installing these rubber mountings, vibration is no longer noticeable to tenants in any part of the building.

## Two-Two-One

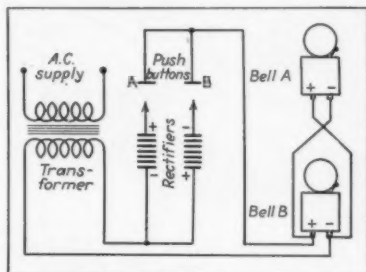
An engineer who specializes in signaling devices was telling about some problems he helped solve. One solution is passed along to the electrical maintenance man—it is on how two push-buttons can ring two bells over the same pair of wires.

A pushbutton in a plant office was connected to a polarized bell at the far end of the plant. An additional pushbutton was wanted in the office to ring another bell to be located in a department nearer the office. Additional wires could not be pulled through the conduit of the low tension system.

The first thought was to run a wire to the location for the second bell, but this arrangement was finally eliminated as impracticable. By making inquiry it was learned that an additional pushbutton, an Edwards No. 551 bell, an Edwards No. 88 transformer connected on the 12-volt tap, and two Edwards rectifiers could be used with the original two-wire system. The diagram shows the connections for the equipment.

The polarized bell has a permanent magnet which is used to cut off one-half of the a.c. wave. By reversing the

wiring, the magnetic effect produced by the current to bell "A" is neutralized by the permanent magnet; whereas in bell "B," the magnetic effect of the current is strengthened by the permanent mag-



**SELECTIVE RINGING** obtained with polarized bells, connected in multiple with reversed wiring.

net, which causes bell "B" to ring. When the other push button makes contact, bell "A" would receive the magnetic effect and bell "B" is silent.

### 33 Telephone Wiring Suggestions

Intercommunicating telephone systems of various types have been designed as a convenience in saving unnecessary footsteps, and to expedite the operation of hospitals, hotels, factories, offices, public buildings, schools and homes. Unless a telephone system is properly designed and maintained, however, it cannot do its work. In the majority of cases faulty installation is the cause of trouble.

The following suggestions are offered to overcome most of the difficulties and to insure satisfactory and continuous service:

#### A—Wiring

1. Use braided wires in dry locations.
2. Use leaded wires in damp or wet locations.
3. Protect wires against mechanical injury where they pass through floors or walls.
4. Seal ends of leaded cables with wax after "skinning" to prevent moisture from entering cable.
5. Boil ends of cables in wax after lacing.
6. Use connector strips to terminate wires in pull-boxes and interconnection cabinets.
7. Support wires and cables properly by cable clamps of proper size; bridle rings and insulated staples.
8. Form drip loops at points where cable or wires enter buildings.
9. Check for proper size wire. Some systems require larger wires where certain distances are exceeded.



**A** VAILABLE from stock for service replacement in all makes of electric motors from 1-40 to 60 hp completely machined and finished, ready for immediate assembly.

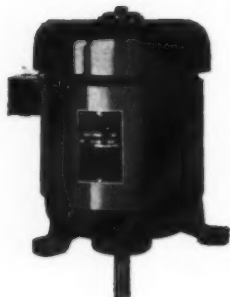
**BUNTING ELECTRIC** Motor Bearings embody many exclusive qualities developed in long continued comprehensive research in collaboration with leading motor manufacturers.

When you buy them from stock for service replacement you are getting the perfected product of intense specialization and vast experience in electric motor bearing application. . . . The Bunting Brass & Bronze Company, Toledo, Ohio. Branches and Warehouses in All Principal Cities.

**BUNTING**  **Quality**  
**BRONZE BUSHINGS • BEARINGS**  
**MACHINED AND CENTERED BRONZE BARS**  
**BABBITT METALS**

# MOTORS

*of Special  
Design \*\*\**



**T**EXTILE loom motors; splash-proof motors for dairies and wet places; vertical motors—these are only a few of the special designs Peerless has available. Peerless builds special motors for grinders, pumps and equipment of all kinds. Range of sizes  $\frac{1}{4}$  to 10 horsepower. Send us your drawings and specifications.

*The Peerless*  
ELECTRIC COMPANY • WARREN, O.

10. Avoid running wires and cables near belts driving machinery, because of trouble caused by static discharges.

## B—Conduits

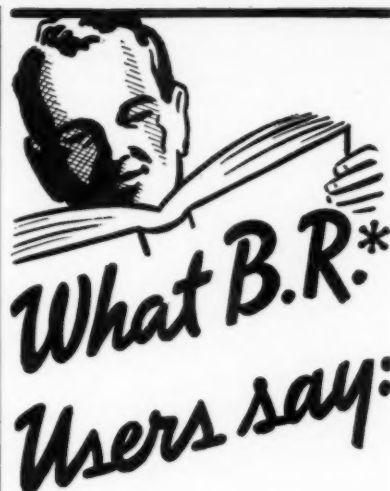
11. Ream ends of conduit to remove burrs.
12. Paint all joints to prevent moisture from entering.
13. Use conduit ample in size in order to avoid abrasion.
14. Use pull-boxes instead of bends and offsets where possible.
15. Avoid running conduits over boilers or adjacent to steam and water pipes.
16. Conduits running through floors should have small pitch for moisture drainage.
17. Where conduits enter pull-boxes, outlet or terminal boxes locknuts and bushings must be tightened and painted.
18. Plug ends of conduits as soon as runs are completed.
19. Before pulling in wires, clean out conduit with a swab attached to end of a "snake."
20. Run conduits so that outlet boxes of instruments may be installed flush with the finished plastered walls.

## C—Instruments

21. Install telephone instruments in accessible location.
22. Do not install telephone on damp or wet walls, or where there may be excessive heat.
23. Avoid noisy places or locations having excessive vibration.
24. Avoid placing telephones near windows, or on the outside of buildings unless protected by weatherproof cases.
25. Avoid placing telephones over radiators.
26. Avoid placing telephones back to back.
27. Avoid placing telephones where they are likely to be injured by doors or furniture.
28. Install telephone at a convenient height so that all may reach it.
29. Connect telephone in accordance with manufacturers diagrams.
30. Test system before leaving job.

## D—Power Supply

31. If dry cells are used for talking, ringing, or both, install them in dry cool place, inclosed in cabinet with lock and key. Test at least every 30 days.
32. Where a.c. is available, use rectifier of proper size, with proper d.c. output for talking, and correct a.c. or d.c. taps for ringing.
33. Where storage battery is used to operate system, see that battery is properly charged at all times.



"To me, the necessity of having a reference of this kind at my elbow at all times, seems so obvious that I can't understand how any contractor or estimator can be without it."

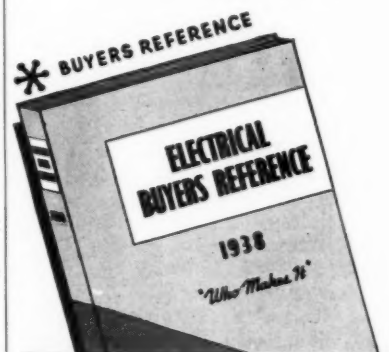
Andrew A. Schroeder  
Electrical Contractor  
Albany, N. Y.

"We have been looking for just such a guide but were not sure where to go to obtain one."

John H. Pierce  
Pierce Electric Company  
Chicago, Ill.

"The book is in my catalog files and I can assure you it will be referred to frequently, as have been the previous issues of the same publication."

Harry W. Benton  
Plant Engineer  
Pratt & Whitney  
Hartford, Conn.



A McGraw-Hill Service  
Published Annually by

**ELECTRICAL  
CONTRACTING**

330 W. 42nd St., New York, N. Y.

*Electrical Contracting, April 1938*



## MIKE'S MAINTENANCE MANUAL

By J. M. Zimmerman

Service Division,  
Westinghouse Electric & Manufacturing  
Company, Chicago, Ill.

### "A Mica V-Ring Shine Will Surely Save Your Time"

**A** LARGE percentage of commutator failures are caused by faulty maintenance of the front mica V-ring. Invariably a commutator fail-

ure means a roasted-out armature. Every front mica V-ring should have the following treatment:

1. Clean the front mica V-ring and front edge of the bars thoroughly.
2. Paint with a heavy air-dry shellac.
3. While it is still wet, wrap the mica V-ring with a layer of untreated Italian twine.
4. Paint twine with black baking varnish and iron in with a hot soldering iron.
5. Repeat operation number 4.
6. Paint with two coats of air dry, oil proof, red enamel.

This treatment leaves the mica V-ring with a glossy surface. Every two weeks this surface should be wiped off. This "mica V-ring shine" will always save time because it prevents equipment failures.

## How ABOUT IT?

### Questions

### and Answers

**Q.** What will be the effect on the operation of a motor if an armature has a reversed polarity coil? Will the coil burn out while the motor is running?

**A.** The coil will not burn out. However, the magnetic condition of the armature will be unstable and cause unbalanced torque which will affect the operation of the motor. Also, it will cause sparking at the brushes and a rise in temperature of the armature.

**Q.** Two 480-volt 60 cycle generators are operated in parallel part of the time. What would be the simplest and easiest procedure to follow in paralleling the generators in case the synchroscope fails?

**A.** The generator that is to be put on the line should be brought to as near synchronous speed as possible and, without field excitation, close the generator oil switch. This will connect the armature to the bus and, if below synchronous speed, the generator will speed up and operate as an induction motor. With the generator field resistance nearly all in, close the field switch. The field will start to build up, bringing up the generator voltage and smoothly pull the machine into step. Adjust the field to the required strength by slowly cutting out the resistance.

**Q.** We have had some difficulty in accurately setting trip-coils which range from 80 to 400 amp. on three-phase, 550-volt circuit breakers. What is the best method of making the adjustment?

**A.** A most dependable practice to assure the proper operation of an oil switch is to apply to the trip-coil, from a separate circuit, the current which is to open the breaker. The entire oil switch should be permitted to function in order to make certain that all parts operate.

## Prest-O-Lite Trade-Mark TORCHES AND SOLDERING IRONS...ideal for electrical work



● Prest-O-Lite Torches and Soldering Irons are available in convenient and moderately priced outfits, covering every open-flame or enclosed-flame requirement of the electrical contractor. These appliances are economical equipment for soldering, heating and brazing.

Prest-O-Lite appliances operate on Prest-O-Lite Gas, which can be obtained conveniently in small tanks at any of the thousands of Prest-O-Lite Gas Exchange Service Stations. You exchange your empty tank for a full one and pay for the gas only.

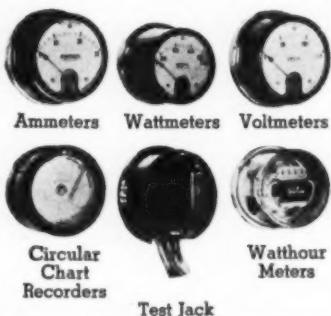
Your jobber will gladly demonstrate the many features of Prest-O-Lite equipment. Call him, or write the Linde office near you.

THE LINDE AIR PRODUCTS COMPANY  
Unit of Union Carbide and Carbon Corporation  
In Canada:  
Dominion Oxygen Company, Limited, Toronto

**THIS LOW-COST  
SOCKET  
MAKES INSTRUMENT USE  
EASY • PRACTICAL • PROFITABLE**

**COMPLETE LINE  
OF INSTRUMENTS  
TO FIT . . .**

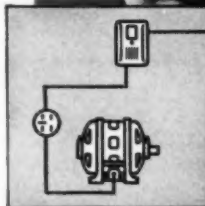
There is a complete line of low-cost socket instruments to fit Westinghouse Type "S" sockets.



Ammeters Wattmeters Voltmeters

Circular Chart Recorders Test Jack Watthour Meters

**Send** for Booklet B-2136 — "Socket Instruments"—explaining how to gain instant access to valuable facts at lower cost than ever before.



Type "S" meter sockets — for five years the standard watt-hour meter mounting — now make instrument use as simple and convenient as plugging an electrical appliance into a home convenience outlet. No wiring connections to make — no production losses from circuit interruptions during tests.

Westinghouse Sockets are easily installed in the conduit, giving instant access to valuable power and machine performance facts. Send today for full information about this new key to lower cost maintenance, improved production control, and reduced power costs. Westinghouse Electric & Manufacturing Company, Department 7N, East Pittsburgh, Pennsylvania.

J-40145



**Westinghouse**  
ELECTRICAL INSTRUMENTS  
*"The Standard of Accuracy Since 1888"*

# Better Lighting

## FOR INSPECTING HIGHLY POLISHED SURFACES

The diffusion and brightness of the luminaire used for inspecting highly polished objects depends upon the area of the object.

1. For small objects, such as needles, a clear lamp in an open reflector would furnish proper diffusion.

2. For inspecting polished objects the size of razor blades and roller bearings, the greater diffusion, of frosted lamps or stippled cover plates, would suffice.



**FOR POLISHED PLATES**—Special units providing low brightness through white paper, with five 750-watt lamps.

3. Objects up to a foot in diameter need brightness no greater than that of white bowl lamps in open reflectors or glassteel diffusers.

4. Large areas such as tin plate or sheet aluminum, require luminaire brightness over a comparatively large area and should employ special equipments.

In the plant manufacturing polished plate shown here, the lighting units are designed to provide a low brightness source. Each unit is equipped with five 750-watt lamps, the bottom covered with ordinary white tracing paper to diffuse the light and eliminate the hazard which would be present if highly diffusing glass were used. Each unit is 10 feet long and 3 feet wide, and is mounted 42 feet above the floor.



**FOR PRINTERS' STONES**—Shallow box units with opal glass face to eliminate reflected glare.

Over the imposing stones in printing plants, a unit of large area is necessary to reduce glare. Type is generally shiny because the shoulder or flat depressed portions of a piece of type act as a mirror against which the characters must be silhouetted if they are to be readily discernible.

One effective unit shown in the picture consists of a shallow steel box, the bottom faced with flashed opal glass. The fixtures are 36 inches wide and 56 inches long. Either 100- or 200-watt lamps may be used, depending on the



**FOR SMALL PARTS**—Bright plated parts are inspected here under 50 foot-candles of intensity in indirect units.

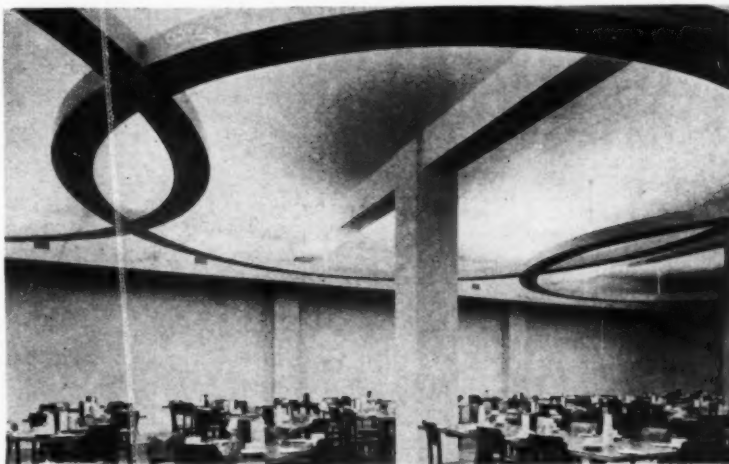
age of the composer.

In one example, in a study made by the Industrial and School Lighting Committee of the Illuminating Engineering Society, it was necessary to detect small scratches and buffed-through places on small chromium plated parts. To catch these defects rapidly required light highly diffused, with a minimum of glare on an illumination of the order of 50 to 60 footcandles. The problem was also complicated because of the large areas involved. The solution was a unit now commercially available.

## NOVEL LIGHTING IN FACTORY RESTAURANT

The Lighting Service Section of the Philadelphia Electric Company has lighted the restaurant of the Edward G. Budd Manufacturing Company of Philadelphia in a unique manner.

The lighting fixture is in the form



**DISTINCTIVE THOUGHTS** in overlapping circles make an effective lighting installation in the Budd factory restaurant.

## OUTSTANDING REASONS FOR

# QUAD

### POPULARITY WITH CONTRACTORS

- flexible design
- strong construction
- good appearance
- ease of installation

The Quad line of lighting units is popular with Contractors because it meets all lighting needs. They can go after more lighting jobs because of the ease of wiring and installation and the assurance of good-looking finished work. Go after more lighting jobs with the Quad Line to help you and make more money.



**Dome Reflector for Mercury Vapor**  
Porcelain enameled green outside and white inside. Designed for 400 watt high intensity mercury vapor lamp. For general industrial illumination. Its wide distribution characteristics effect combined with the shielding ring of the deep glass diffusing unit make this a most practical unit for comparatively low mounting.



**Post Top Reflector**  
Designed for the general illumination of outdoor locations where a practical fixture of good appearance is important. The unit consists of a green porcelain enameled reflector, white inside with ornamental knob attached to an unshaped cast aluminum socket housing by means of heavy cadmium plated iron rods. Three sizes of reflectors accommodate lamps from 200 watts to 1500 watts.

#### Duplex Dome

Duplex Dome delivers direct light downward and illuminates upper walls and ceiling with diffused light. Louvers formed in metal walls of reflector direct sufficient light upward to relieve light upward contrast between bright reflector and dark background. White porcelain enameled exterior of reflector and supporting stem are also illuminated as shown. Standard 1/2" socket type also with heavy threaded hood. —3/4" if specified.



RIGHT

**Vapor Proof Fixture and Reflector LEFT**  
Standard construction comprises a green enameled cast iron threaded body, a clear glass globe with threaded neck, and a green porcelain enameled reflector. Three body styles include 1/2" vertical, 1/2" horizontal, (3/4" if specified) and outlet box type in both medium and mogul sizes. Four types of reflectors.



RIGHT

**QUADRANGLE MFG. CO.**  
32 S. PEORIA ST. CHICAGO, ILL.

# QUAD

*Better Lighting*

[FROM PAGE 57]

of three intersecting circular troughs, suspended 2 feet below the ceiling surface. The troughs contain individual reflectors with Alzak finish, spaced on 2 foot centers. The units, which are removable to facilitate cleaning, are equipped with 40-watt lamps on the overlapping section and 75-watt lamps in the single portions.

The restaurant is 40 feet by 80 feet with a 12-foot ceiling which has an ivory finish. A buff color is used on the walls and green on the columns and pilasters. The room is air-conditioned. Two and one-half watts per square foot provide 8 foot-candles average in service. The lighting equipment was manufactured by the Voight Company of Philadelphia.

### SCHOOL LIGHTING SURVEY RESULTS

Early last year the Edison Electric Institute began a survey on school lighting which brought replies from ninety-eight power companies located in all sections of the country. These replies provide information as to the lighting trends in some 275,000 schools attended by 32,000,000 pupils. Here are some of the findings—

1. The average classroom size is almost universally 24 ft. by 30 ft.
2. Average artificial illumination intensity is 4 ft. candles.
3. Most common lamp size is 100 watts.
4. Lamp sizes in use range from 60 to 200 watts.
5. Fixtures include bare bulbs, open reflectors and enclosing globes.
6. Relighting recommendations made by lighting bureaus show that—
  - (A) 52 per cent recommend semi and fully indirect lighting.
  - (B) 48 per cent recommend direct enclosing globes.
  - (C) 80 per cent recommend six lighting outlets per classroom.
  - (D) Average total of 1800 watts per room recommended, to give about 15 ft. candles. Of the 90 replies, 16 recommend 6-400 w., 10 recommended 4-500 w., 2 recommend 6-200 w., and 2 recommend 6-750 w.

This survey was made because school-room lighting has attracted wide attention among educators, parent-teacher groups and school authorities. A brief summary of the 90 replies is covered in a sixteen-page report entitled "Trends in School Lighting", published for utility executives by the Edison Electric Institute, 420 Lexington Ave., New York.

*Electrical Contracting, April 1938*



*The Line forms on the  
Right •• or on the left ••*

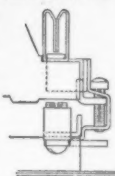
## with the New No. 2 Standard COLT-NOARK Meter Troughs

Right or left . . . one meter or a hundred . . . it's all the same when you're installing the new Colt-Noark No. 2 Troughs. They're marked by their versatility and adaptability to almost any set-up that requires use of troughs. Built for quick and efficient installation . . . horizontal type for both indoors and outdoors. Vertical type for outdoor service only.



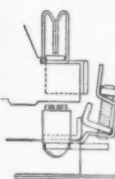
### FEATURING NEW TYPE METER DISCONNECT

A feature of these new No. 2 Troughs is the new and ingenious meter disconnect. The sketches at the right show the new mechanism both closed and opened. Quick and easy to operate . . . simple in design . . . positive in operation. Supplied in all of the new No. 2 Colt Standard Troughs.



### VERTICAL AND HORIZONTAL . . . INDOOR AND OUTDOOR

The indoor types are furnished for horizontal mounting, using one to four meters. By the use of coupling straps, indoor troughs may be assembled to include any number of meter locations . . . adding either to the right or the left. Outdoor types are supplied for horizontal mounting, using two, three or four meters. In the outdoor vertical type, troughs accommodate from one to four meters. All have ample wiring room . . . plenty of knockouts and are ruggedly built. They save installation time and require a minimum of space.



Indoor troughs furnished in sheet steel, baked aluminum finish . . . or in sheet aluminum, natural finish. Outdoor troughs furnished in galvanized steel, baked aluminum finish . . . or in sheet aluminum, natural finish.

COLT'S PATENT FIRE ARMS MFG. CO. Electrical Division HARTFORD, CONN.

100 Years of Manu-  
facturing Experience  
is back of every Colt  
Built Product

# COLT-NOARK

SWITCHES INDUSTRIAL CONTROL EQUIPMENT FUSES

Boston  
New York  
Chicago  
Philadelphia

# Questions ON THE Code

Answered by  
**F. N. M. SQUIRES**

Chief Inspector New York Board of Fire Underwriters

## Non-Tamperable Fuses

**Q.** "Can you give the reason why non-tamperable fuses are optional in this Code and what have we to protect the 15 ampere branch circuit from being overfused by uninformed persons?"—J.B.C.

**A.** Our correspondent has reference to the fact that while non-tamperable fuses were permissible or optional in the 1933 Code, the 1935 Code made them mandatory on July 1, 1937. But the 1937 Code reverted them to the optional status.

The reason can be found in the Minutes of the 1937 Meeting of the Electrical Committee, the Minutes of the 1937 Meeting of the N.F.P.A. and in the Columns of the News-Bulletin of the International Association of Electrical Inspectors. It is hoped that the next edition of the National Electrical Code will make the use of non-tamperable fuses mandatory where fuses are to be used. Then we can expect to have some protection against the overfusing of branch circuits. Such overfusing is of course, extremely prevalent at the present time.

## Service Equipment Sequence

**Q.** "Is it necessary to have entrance switches ahead of plug fuse cabinets in residences or any other small building of several branch circuits."—A.C.B.

**A.** Section 2371a4 says that not more than six sets of fuses may serve as the service overcurrent device, if each fuse is controlled by an individual disconnecting means. This requires, therefore, that a switch must be ahead of each fuse, unless a single main disconnecting means is provided in the same cabinet with the fuses and ahead of the fuses.

## Service Fuse as Circuit Fuse

**Q.** "According to the Code is it necessary to have a fuse cabinet for only one branch circuit next in line with a 30 amp. entrance switch, for lighting a small building? Could the entrance switch serve also as a branch circuit cut-out?"—A.C.B.

**A.** Section 2373 requires that if the service fuse is locked or sealed there shall be accessible fuses provided on the house side of the service equipment. Therefore, by the wording of this rule, the Code implies that, if the service fuse is not sealed or locked and is of the proper size (15 amp.) to protect the branch circuit, it will be the only fuse required.

## Conductors in Multiple

**Q.** "Is it 'Code' to use two #10 wires as the neutral with two #4 wires in a 110-220 volt circuit? I ran across a job like this the other day and would like to know if it is O.K. There are two electric ranges and a three burner hot plate connected to this circuit. Two #10 wires are used as one wire for the neutral."—L.H.

**A.** Such an installation should not be approved. The tendency would be to fuse the #4 wires at 70 amperes which would exceed the safe carrying capacities of two #10 wires taken together. Even if the outside wires were fused at 50 amps. the installation would not be within the intent of the Code.

Section 3007 rules that conductors may be used in multiple only by special permission of the inspection authority and gives a reference to Section 3052. This latter section indicates that multiple conductors should only be used where it is desired to furnish large current carrying capacities. Where wires

are used in multiple all individual conductors should be of the same size.

A recent ruling dealing with this subject by a large municipal inspection department is in keeping with the general requirements for this type of work. It is given here for guidance.

It says—

"The number and size of conductors which may be combined in multiple are as follows:

Two (2) . . . . . # 2/0 A.W.G.

Three (3) . . . . . # 3/0 and up to and including 350,000 C.M.

Four (4) . . . . . # 400,000 and up to and including 1,000,000 C.M. . . . .

provided they terminate in a common lug or in separate lugs which are sweated, brazed, riveted or bolted to a common bus or connecting strap, and provided further that they are as nearly as practicable of the same length and are of equal size and will not be fused greater than their safe carrying capacities."

## Mandatory Outlets

**Q.** "Is Section 2110, Article 210, of the new 1937 Code compulsory when wiring old houses? On some old work it would add a large sum to the expense of wiring and seems not to be practical in some cases. I have several customers who will not wire their houses if they have to install all of these receptacle outlets. Must I lose these jobs because of this?"—F. W.

**A.** Section 2110 requires that a receptacle outlet be provided every 20 feet measured horizontally along and around the walls of every kitchen, dining room, breakfast room, living room, parlor, library, den, sun room, recreation room and bedroom.

The question of enforcement of this adequacy requirement has been raised many times and is still in the minds of many. It has repeatedly been found that a lack of an adequate supply of receptacles in the large majority of houses engenders fire hazards due to the promiscuous use of flexible cords and other "haywire" wiring, and it is certainly proper and legal to legislate against fire hazards.

When a sane view is taken of this requirement, it will be apparent that there is really no undue hardship involved. In a square room 10 ft. by 10 ft. but two receptacle outlets would be required. In a room 15 ft. square or a room 10' X 20' only three receptacle outlets would meet the requirement. And it must be remembered that no other outlets, such as fixture outlets,



There is a way for the electrical contractor to avoid the pressure for low bids, and that is to do a selling job backed up by facts.

In circuit protection, for instance, Westinghouse Nofuze equipment has the selling facts that can't be squeezed.

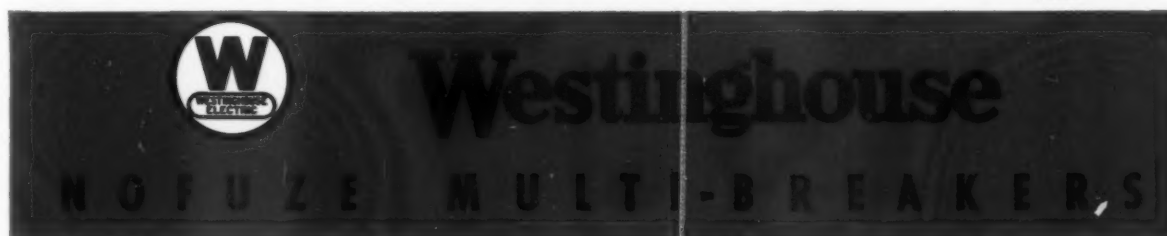
Nofuze switchboards and panelboards pay the owner dividends every year. They save a substantial amount in the current consumed by the units themselves. They save unnecessary service interruptions. They banish costly losses of time by employees operating elec-

trical equipment. And they are absolutely safe and tamperproof, identifying the contractor who installs them with the highest quality electrical work.

Send for the Westinghouse "Where, When and Why" chart that tells you about Nofuze equipment, gives you the selling facts, and describes the units recommended for homes, commercial buildings and industrial applications. Simply write your nearest Westinghouse sales office or wholesaler.

WESTINGHOUSE ELECTRIC & MANUFACTURING CO., EAST PITTSBURGH, PA.

J 60206



## Better Lighting with Same Operating Cost for Show Windows & Interiors



STER-LITE FIXTURES

## Capture Store Lighting Business! with Sterling EXTRA Lighting Value!

Merchants are seeking more selling value from the dollars they spend in lighting stores and windows.

That's why Sterling Lite-Flo Reflectors and Ster-Lite Fixtures are so widely used by leading merchandisers. And that's why so many contractors have found 'Sterling Extra Lighting Value' affords the closing punch that lands commercial contracts for them.

Try it once! Talk Double Lighting Effectiveness with Lite-Flo Reflectors for show windows and Ster-Lite Fixtures for store interiors.

We'll help you by furnishing literature with pictures of installations—data that shows superior results—special layouts that assure outstanding lighting efficiency for your jobs.

Just send us data on the job for special lighting layout or mail the coupon for literature and complete information.



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Information  
MAIL  
THE COUPON

**REFLECTOR & ILLUMINATING CO. CHICAGO**  
1435 West Hubbard Street

☐ Send brochure, "Increased Sales Punch with Same Operating Cost."  
☐ Send bulletin on Ster-Lite Fixtures.  
☐ Send catalog on complete Sterling Line.  
☐ Have your representative call.

Name.....  
Address.....

*Questions  
IN THE  
Code*

[FROM PAGE 40]

would be required. Many homes are now being wired without any fixture outlets in the rooms. All of the lighting is being taken care of by portable lamps attached to receptacles.

### Knob & Tube & Thermal Insulation

**Q.** "When thermal insulation to conserve heat in old buildings is applied where knob and tube wiring exists, the wiring job generally suffers. How about wires on knobs in a partition installed as per Code and then someone comes along and fills the partition with insulation of one of the various kinds on the market? As the installation did not require loom where the wire was properly supported, the insulation will pack directly against the wires. Between joists in the attic the clearance for the wires is reduced also in many cases."—G.G.

**A.** Underwriters' Laboratories list several brands of thermal insulation which may be blown into the hollow wall spaces of a building and allowed to be in contact with whatever wires may be in the walls. These approved brands of thermal insulation will have no injurious effect on the insulation of the wires. Being of insulating material themselves, they may be left in contact with the wires. This is permitted by Section 3249.

But unapproved thermal insulations should not be used nor permitted. Many of them contain substances which are harmful to the insulation of the wires. Some are combustible. Some are corrosive. Some absorb moisture. All of this makes them dangerous.

### Is a Fixture an Appliance?

**Q.** "In rule 2107-b is a lighting fixture a fixed appliance?"—F.E.R.

**A.** In some senses a complete lighting fixture is an appliance, since it is a current consuming device. But without the lamps in the sockets it does not consume current. Then it could be held that it is not an appliance.

With the definition, as given in Article 100, the intent of the Code is evidently not to classify fixtures as appliances. This then would have the effect of placing fixture outlets under the category of "other outlets" at 1½ amperes each, for the purpose of determining the number of circuits in accordance with 2107-b.



## LOADED CIRCUITS *don't* worry **FUSTAT** users

### **Stops needless blowing**

You can load an ordinary circuit right up to capacity and yet protect it with a 15 ampere Fustat. Its long time-lag keeps it from blowing needlessly as when motors start on washing machines, refrigerators, oil burners and the like.

By eliminating needless blowing, the Fustat *wipes out the only possible excuse for tampering or using over-size fuses.* Yet the Fustat . . .

### **Stops overloading of circuits**

The Fustat cannot be replaced with a penny or other substitute for the fuse — or with a size too large to protect. In fact, side-tracking protection in any way is practically impossible without destroying Fustat or Adapter and thereby clearly showing the user that his protection is gone.

### **Fits present fuseholders**

Thru the use of an inexpensive adapter that locks in place, the Fustat fits in any standard Edison base fuseholder.

On new jobs, you can specify that panels, switches, etc., be equipped with Fustat bases.



Retails at 7½¢

If additional circuit capacity is needed, users cannot readily side-step the issue — at the sacrifice of safety.

Destruction of circuit wiring is prevented — fire hazards are reduced — costly shutdowns and expensive repairs are avoided.

### **Prevents hazardous burnouts of flexible cords — in spite of long time-lag**

The Fustat contains a fuse. The ability of a fuse to protect against dangerous cord shorts, grounded sockets, etc., is well known.

The quick action of the Fustat on such dangerous "household shorts" prevents spraying of molten metal, starting of fires, burning of users.

### **Answers today's demand for trouble-free circuit protection**

What other device than the Fustat can permit circuits to be loaded to full capacity — yet prevent dangerous overloading . . . make safe protection remain safe . . . protect against dangerous cord shorts . . . and eliminate needless blows and service interruptions?

*Using Fustats for circuit protection — is just good business*

# The FUSTAT



For all information write to any of these firms —

JEFFERSON ELECTRIC CO., Springfield, Ill.  
 FINEMAN ENGINEERING CORP., 121 South Street, New York City  
 NATIONAL ELECTRIC PRODUCTS CORP., 1000 15th St., Pittsburgh, Pa.

# Questions ON Signalling

Answered by  
ALBERT A. SCHUHLER

## Automatic Safeguard for Nurses Call

**Q.** A low-tension locking-button type nurses call system is at present installed in a hospital. We wish to improve this system by adding a feature which will automatically turn on the associated signal lamps in the event the portable cord becomes detached.

How may this feature be added? Is any additional wiring required?—G.K.

**A.** This development commonly known as the safeguard feature is accomplished by the action of the plug on the end of the signal cord, against the nurses station receptacle on the wall. In most cases when the plug is disconnected accidentally or otherwise, a plunger on the nurses station receptacle is released, and causes all contacts to close. This action causes all lamps connected to this receptacle to illuminate. The lamps remain illuminated until the cord is replaced, or until a small switch is operated, or until a dummy plug is inserted into the receptacle.

No wiring of any kind needs to be added or changed in order to add this feature to existing stations. It is only necessary to replace the present receptacles with new receptacles incorporating the safeguard feature. In most cases it will also be necessary to replace the plug with one which will operate with the new receptacle. These parts should be obtained from the manufacturer of the original equipment, to be assured that all parts will fit and operate properly.

## Progressive Conveyor Signals

**Q.** A lamp type signal system is desired which will permit signalling from one point to another on a conveyor system. The general idea is to make up special orders, and add items as the baskets are sent from one conveyor to another. Each conveyor attendant upon

completion of his work is to operate a button in order to signal the conveyor attendant next in line of assembly. Each attendant resets his respective lamp and operates the next lamp in line of the special order assembly, the basket passing some points along the line if desired. Please give diagram of wiring and advise type of apparatus required. The system is to operate on 24 volts D.C. We require equipment for eight points of control—C.B.

**A.** A system of this type will have a push button at each station, and a lamp at all points except the first station. To control the system use a step-up relay operated by a solenoid which steps-up contacts made between an arm and points on a disk, each time it is energized.

The operation of a push button operates the movable arm for a space of one contact, and causes the lamp corresponding to that circuit to remain illuminated, until any push button is again operated. Any of the points on the disk may be passed by operating any

push button the required number of times, corresponding to the number of points to be passed.

## Body capacity protection system

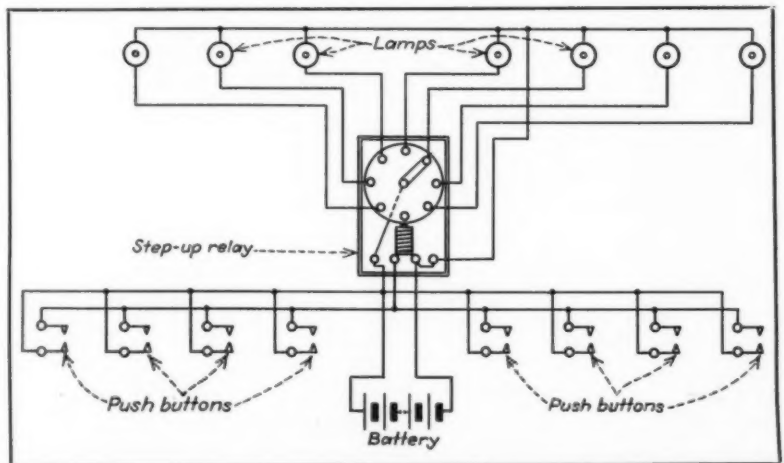
**Q.** What form of burglar alarm protection would be most suitable for sending an alarm, should a burglar come within one or two feet of an object?—A.G.

**A.** The system best suited is generally known as a body capacity system. Such a system can be so regulated as to become effective as soon as a person reaches a short, pre-determined distance from a certain object. This type of system is affected by the body capacity of the person within its range.

## Several systems on one battery

**Q.** Considerable trouble is being experienced with some signalling equipment in a school. Several systems are involved, all supplied from the same battery. We find that the minute impulse clocks, telephones, bells and open-circuit fire alarm systems are connected at different points from this battery. The clocks scatter and the telephones are not clear. What can be done to remedy this trouble?—F.C.

**A.** Just as long as all of these systems are connected to the one battery this trouble will continue. Each system should have its own source of current. Such a layout would also prevent a complete interruption of all systems, in the event of serious trouble in any of the systems, because each system would be isolated from the other.



CONVEYOR CONTROL—Wiring diagram for operating signal system along a conveyor.

# A Pointer

## ON G-E TIME SWITCHES

REPEAT ORDERS—evidence of customer satisfaction—will be yours when you sell G-E time switches. Buyers are always pleased by the years of attention-free service. They may not realize that this is caused by an accurate, Telechron motor, extra-heavy silver contacts, and a “tough” design, but they do know that they never have trouble. There is no servicing—no bother. Of course, this brings you repeat orders as well as other new business. Write for Bulletin GEA-1427F. Get several copies and build more business by sending them to your customers.

### YOU BENEFIT IN OTHER WAYS

YOU will find your wiring job will be easier when you use G-E time switches. Liberal spacing below the terminals, five convenient knock-outs for conduit connection, connecting lugs, and easy time-setting simplify your work. Wiring time is reduced—on every installation you get the profits you should.

G-E time switches eliminate expensive, profit-consuming service calls. Once the switches are wired, you and your customer can forget them, for they will give the same fine service, year after year, without attention.

Use G-E time switches on your next sign or store-window lighting installation. For further information and prices, see your G-E distributor or write to General Electric, Schenectady, N.Y.

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SATISFIED CUSTOMERS

*New*



## Two-Way Duty AC CIRCUIT BREAKER

**DOUBLE PROTECTION!** There are 2 distinct advantages built into this newest exclusive thermal type trip free **FA** AC Circuit Breaker.

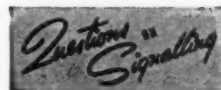
- (1) It assures automatic, positive protection against short circuits or sustained overloads,
- (2) It is designed with the proper time lag characteristics that prevent needless circuit interruptions when momentary overload occurs.

Trip free — non-closeable on overloads and short circuits . . . Especially adapted to range and service equipment protection — and light and appliance branch circuit panelboards, up to 40 circuits . . . For 125 volt AC service . . . 5 to 50 amperes.

### *Automatic Trip . . . Automatic Reset*

When an overload or short circuit occurs the **FA** AC Circuit Breaker is automatically tripped — the tripping action automatically causing the handle to move to the "OFF" position . . . With the same action, the breaker is automatically reset — which means that it is only necessary to return the handle to the "ON" position to restore service.

**Frank Adam**  
ELECTRIC COMPANY  
ST. LOUIS



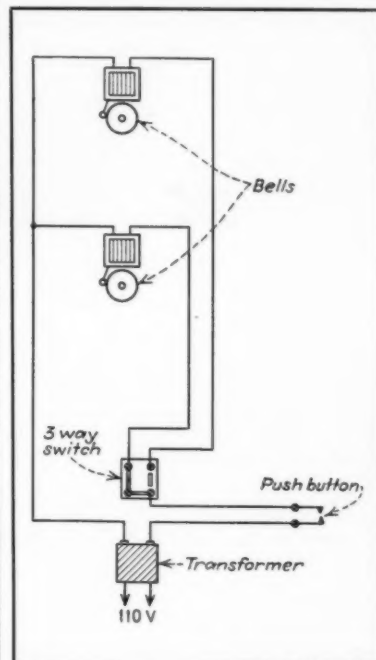
[FROM PAGE 64]

Tapping of cells in a battery also has a tendency to weaken some of the cells. This results in an unreliable source of current, and causes noises in the telephone system. When the program bells or the fire alarm systems are operated at the moment that the secondary clocks "step up," a great amount of current is drawn from the battery and causes the clocks to scatter because some of the clocks do not receive sufficient current.

### Signal Transfer Switch

**Q.** What provision can be made on a door bell circuit for switching the signal to either of two rooms, so either of two persons who may be on duty at a specified time, may answer a call originating at the front door.— C.B.

**A.** For such an application, either a two-point lever switch or a mid-get or standard three-way switch may

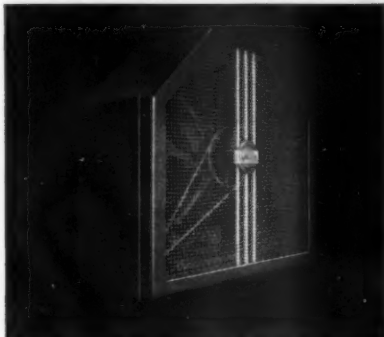


**SIGNAL TRANSFER**—Standard three-way switch used to transfer signals to either of two rooms.

be used. The three-way switch is preferable because it is more positive in action, and may be readily obtained.

The diagram shows that one bell always remains connected. To transfer the signal to another room it is simply necessary to flip the switch lever to the opposite position.

# FOUR GREAT FIELDS FOR PROFIT



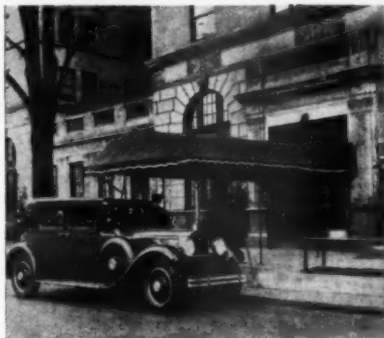
**1 HOMES**—The new improved American Blower Attic Fan (above) answers a tremendous growing demand for Comfort Cooling in homes at low cost. A. S. of H. and V. E. Test Code ratings.



No trade-in—no complicated service problems—no refrigeration or ice required for Comfort Cooling by Attic Ventilation! Installation diagram (above) shows how simple it is. May be financed now on F. H. A. terms.



The American Blower Corporation, the world's largest builder of Air Conditioning and Air Handling Equipment, backs up authorized dealers with its gigantic national advertising and direct mail campaign for 1938.



**2 APARTMENTS**—Now, for the first time, Comfort Cooling for apartments with the new American Blower Apartment Conditioner! (Design and many exclusive features are covered by patents pending.)



Display this beautiful Apartment Conditioner in your store and get the profits from quick, easy sales. Use the attractive mailing folders (furnished to you free), and watch the requests for demonstrations pour in!



Usually, one demonstration in the evening, when the whole family's home, sells this amazing new American Blower portable Apartment Unit. Cool, refreshing air drawn in from out of doors does the selling!



**3 ROOM COOLING**—For cooling a single room, the new American Blower Aeropel Electric Ventilator (above) is your answer to another great demand. Three-speed motor reversible on all speeds.



**4 STORES, OFFICES, ETC.**—American Blower offers the most complete line for Comfort Cooling commercial establishments and offices. 9 sizes of Ventura Fans and 11 sizes of Sirocco Blowers.



American Blower Ventura Fans (above) and Sirocco Utility Blowers (right) are a year 'round source of income!

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# In the News

## NISA SET FOR BIG CHICAGO MEETING

With a program arranged to cover vital topics of sales, management, distribution, engineering and other closely related aspects of the electric service industry, the 1938 Convention of the National Industrial Service Association is expected to attract a heavy attendance. The meeting will be held



W.M. J. WHEELER, New York, who will preside at the 1938 NISA Convention in Chicago.

on April 25, 26 and 27th at the Palmer House in Chicago.

Among the outside speakers who have so far accepted invitations to appear on the program are: Laurence W. Davis, general manager of the National Electrical Contractors Association; H. L. Horton, associate editor of "Electrical Manufacturing," and Earl Whitehorne, editor of *Electrical Contracting*. In addition these active leaders of the electric service industry will speak or present papers—J. E. Launder, Kansas City; F. M. Mielke, Duluth; C. A. Sievert, Chicago; G. P. Svendsen, Minneapolis; F. W. Willey, Cincinnati; P. G. Winter, Indianapolis; and F. O. Sievers, San Francisco.

In planning this year's program the officers were guided by important trends in legislation and labor relations. Industry distribution policies and recent developments in shop methods and products also were included as topics of timely interest. The following list of subjects coming before this convention shows the wide range of information that is to be presented.

National Certified Electrical Repair Shop Plan  
National Rebuilt Motor Exchange Service  
Distribution Policies for New Motor and Control Equipment  
Glass Insulated Magnet Wire and Tape Motor Inspection Service as a Sales Producer.  
Robinson-Patman Act and Anti-Trust Acts  
Methods of Compensating Repair Service Salesmen  
Annual Summary of Rewinding Prices  
Handling Fractional Motor Repairs  
A New Method of Pricing Motor Repairs  
Labor Relations—Wagner Act and similar State Acts  
Profit Sharing Plans in Service Shops  
Open Forum on Improved Shop Methods and New Equipment  
Unfair Dealer Agreements and their correction  
Non-technical Explanation of "Power-factor"

The presiding officer for this meeting is Wm. J. Wheeler, NISA president, of The Maintenance Co., Inc., New York. Other officers are—vice-president, J. E. Launder, Independent Electric Machinery Co., Kansas City, Mo.; secretary, C. A. Sievert, Sievert Electric Co., Chicago, Ill.; treas-



**N.I.S.A. ENTERTAINMENT** Committee meets to prepare a full program for the motor specialists from all parts of the country who will converge on Chicago in April. The annual convention of the National Industrial Service Association will meet at the Palmer House April 25, 26 and 27. Entertainment features will include a banquet and a visit to the world famous Brookfield Zoo. The Chicago host committee includes (left to right) Charles Kaska, Ed James, Sam Hobman, Arthur Wagner, E. J. Ermel, Convention Chairman C. A. Sievert, Joe Ferrari and Roy Hyer.

## More REA Wiring Loans

Simplification of loan contracts by the Rural Electrification Authority is already resulting in more wiring jobs. From now on REA inspection will be more drastic. Until recently the best they could do was a lick and a promise, due to a shortage of competent inspectors. Little training schools for inspectors, have been set up by the fire marshals in many states, however, and now there are said to be plenty to go around.

Figures just received show that it is the middle size wiring job which is encouraged by loans. The chap who wants a good sized complete job apparently does not have to borrow to do it. The householder who wants just a few outlets runs into an expense too small to justify going through the formalities necessary for a loan.

So far the loans are running on an average of about \$100, with the loan covering not more than 80 per cent of the cost of the job in any instance. Only about one-third of all REA projects have loans. Some of them, for various reasons, do not want them. On projects which do have loans the percentage of loans to the total number of jobs runs from 10 to 15 per cent with a few running higher, and one to 50 per cent.

From CARTER FIELD  
Washington Bureau  
McGraw-Hill Publications

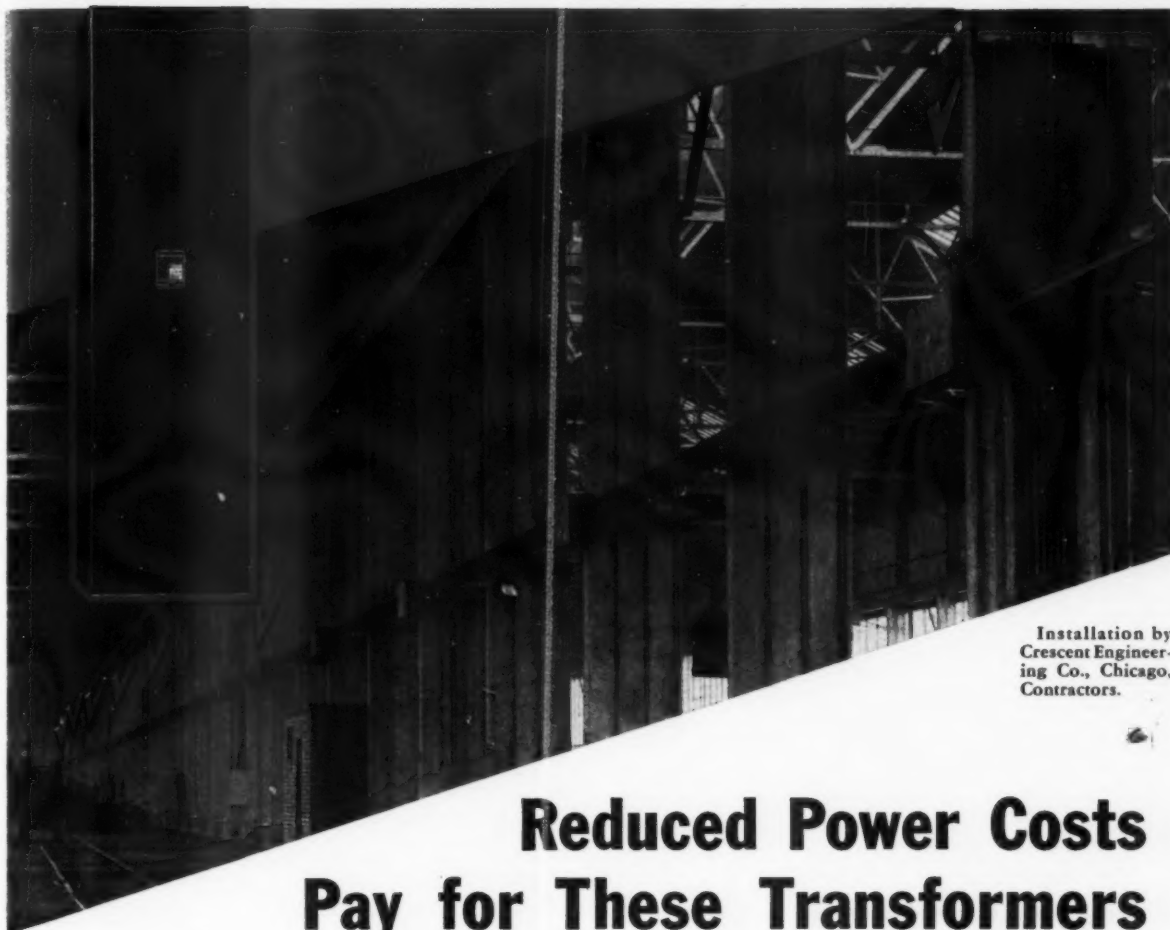
urer, A. L. Brown, A. L. Brown Associates, Inc., Worcester, Mass.

The executive committee is composed of the officers and A. F. Anderson, Nashville, Tenn.; W. W. Hanks, Charlotte, N. C.; E. C. W. Johnson, Indianapolis, Ind.; F. M. Mielke, Duluth, Minn.; H. H. Roessle, Pittsburgh, Pa.

## BOSTON'S BIGGEST TRADE SHOW

With attendance reported well above the 3-day 10,000 record of previous years, Boston's 1938 Electrical Trade Show also set a new standard for arrangement, number of exhibits and types of products displayed. This was the fifth annual trade show sponsored by the Electrical Manufacturer's Representatives Club of New England. It was held March 9, 10 and 11 at the Exhibition Hall in Boston Garden. About 140 exhibits displaying the products of 400 or more manufacturers were viewed by visitors from Maine, New Hampshire, Vermont, Rhode Island, Connecticut and Massachusetts.

Because of the wide diversity of electrical products, the prominence of those exhibiting and the splendid publicity given this show, all branches of the industry responded. Heavy delegations were reported



Installation by  
Crescent Engineering Co., Chicago,  
Contractors.

## Reduced Power Costs Pay for These Transformers

● Present day engineering has pointed the way to economies in wiring installation and in power costs. . . . Lower-cost, high-voltage power circuits are installed, yet without expensive duplication of conduit and wiring—low-voltage current is provided for lighting and various appliances and tools.



Jefferson Transformers are made also for use with mercury lamps, luminous tube illumination, street lighting, etc.

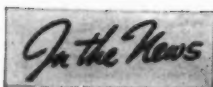
In the modern plant of the Union Metal Products Co., Hammond, Ind., 31 Jefferson air-cooled Power Circuit Transformers step the voltage down from 440 to 230 and 115—a typical example of modern engineering practice.

Let our engineering department give you information on your particular case—savings will pay you for the transformers in a short time. JEFFERSON ELECTRIC COMPANY, Bellwood (Suburb of Chicago), Illinois. Canadian Factory: 535 College St., Toronto, Ont.

# JEFFERSON

*Power Circuit*

Transformers



[FROM PAGE 48]

from utility companies, electrical wholesalers and contractors, service shops, plant superintendents and electricians, consulting engineers, inspectors and rating engineers, mill supply houses and appliance dealers.

Elaborate booths and demonstration models were devoted to new motor applications, drives, pumps, overcurrent protective devices and coordinated controls. High intensity lighting equipment, switches and distribution systems, connectors, new wiring devices, fittings and systems, cable and insulating products, signalling and communication devices were other items of interest. For large industrial plants and power companies there were product displays for voltage regulation, metering, cubicle units, pole line hardware and other fittings. In other words this greatest of all Boston shows had something new and interesting for every branch of the industry.

Credit for the successful 1938 Trade Show goes to a hard-working committee headed by A. J. Hurley, with C. D. White as treasurer, and Charles A. Stone, secretary and publicity director. S. J. King, W. L. Boudrot, J. H. Abrams, D. F. Barnard and J. H. Sullivan completed the Trade Show Committee personnel. The Electrical Manufacturers Representatives Club of New England who sponsored the Show is headed by W. V. Haynes of Cambridge, president; H. J. McDonald, vice-president; C. D. White, treasurer; and S. J. King, secretary, all of Boston.



**FLORIDA OFFICERS**—Heading the Florida Association of Electrical Contractors for 1938 are: (seated) Secretary, F. J. McGinnis, Palm Beach; vice president, W. W. Ingalls, Miami; president, O. V. Scott, Miami; treasurer, R. C. Bigby, Tampa, and (standing) A. T. Wilson, Fort Pierce; R. A. Ragsdale, Tallahassee; W. A. Brinson, St. Petersburg, and S. M. Lantz, Orlando, all executive committeemen.

## FLORIDANS MEET IN ORLANDO

The National Adequate Wiring program, industry standards and cooperation, and 1937 Code discussions were highlights of the Florida Association of Electrical Contractors meeting at Orlando on February 21-23. The attendance totaled 113 contractors and dealers.

Laurence W. Davis, of NECA, urged all industry groups to get together behind the

national program, and A. C. Tate of the A-W Bureau field staff introduced the plan in detail. D. B. Clayton of Birmingham, Ala., NECA executive committeeman, spoke on what NECA was doing, and Victor H. Tousley, secretary of IAEI, conducted a two-day Code school during the meeting. Other speakers included R. H. Turner of the Florida Power & Light Co., J. Roscoe of the Southern Bell Telephone Co., and A. P. Denton of the Rigid Steel Conduit Association. Mrs. J. H. Bennett of Winter Park, Fla., was introduced at the convention as the state's only woman contractor. An appeal was received from Key West for cooperation to obtain National Electrical Code requirements.

These new officers were elected—president, O. V. Scott, Miami; vice-president, W. W. Ingalls, Miami; treasurer, R. C. Bigby, Tampa; secretary, F. J. McGinnis, Palm Beach.

## A-W CAMPAIGN ROLLING STRONG

Last minute reports from the Adequate Wiring Campaign bring good news. So far the two field men have visited 28 cities and presented the program to 67 meetings. Everywhere the idea is receiving enthusiastic support. Already 50 cities have written in for information on organizing local activities and 45 cities have ordered campaign material. New York, Washington and Los Angeles have applied for licenses under the certification plan. Headquarters announces that the sound slide film is now ready and also a sales manual for local meetings.

## ALBANY ASSOCIATION CHARTERED

A charter has been granted to the Albany (N. Y.) Electrical Contractors Association, Inc., by the secretary of State, as



**AT BOSTON SHOW BOOTHS** (top left) H. J. Des Roberts, Lynn Wholesaler, listens while C. Walther, N. E. representative, talks Bull Dog safety to Wm. H. Hughes, Watertown, Mass., contractor and J. L. Winn, Winn Electric Co. of Cambridge, Mass. Connector Technique demonstrated (top right) by A. H. Stubbers, sales manager of IlSCO Copper Tube & Products, for Wm. A. Hugo, mfg. repr. Boston (left), A. Kenneth Hambleton and H. Allen Brown (extreme right), contractors from Goffstown, N. H. At Brush headquarters (bottom left) we found Hi Cohn of Ohio Carbon Co. welcoming Arthur S. Pike, and J. A. Wesner, of J & H Electric Co., and Otto J. Meyer, plant engineer of Narragansett Brewing Co., Providence, R. I. Visiting the Master Electricians "Dugout" (bottom right) are contractors John L. Selig and V. A. Kern of Waltham, Mass., and D. Simms of Brookline.

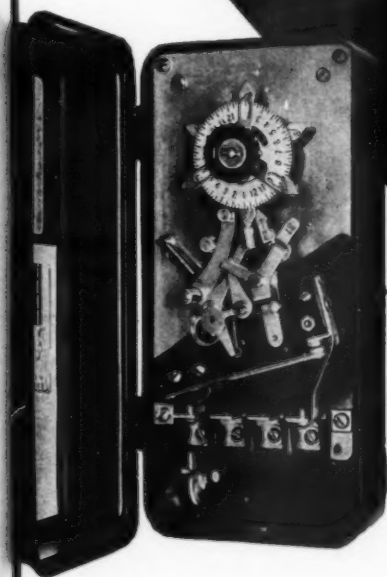
# the Unseen Hand

FORD

Curtis Lighting Photo

that makes this type of installation  
*Completely Automatic*

The final touch that makes any display lighting installation—any electric sign job—complete, is a Sangamo Time-Switch. This Unseen Hand is a very small item by comparison. When you "figure" on this kind of work, don't deny your customers the convenience and economy they will derive from its use!



Sangamo Form K Time-Switch: a reliable synchronous motor geared to a simple, sturdy contact mechanism.

**SANGAMO ELECTRIC COMPANY** **SPRINGFIELD ILLINOIS**

# For Profit - For Prestige

INSTALL

## TRICO

REG. U.S. PAT. OFF.



NO MATTER how good your wiring job may be—cheap, shoddy fuses give the customer the impression that the **WHOLE** job is that way.

Leading Contractors know TRICO'S national reputation for outstanding quality—and how it adds that vital touch of **quality workmanship and material** to every finished job. That's why they say:—

**"Give me TRICO—nothing else will do!"**

Let us send you information on  
**RENEWABLE FUSES**

With the famous powder-packed element

**KANTARK "ONE-TIME" FUSES**

With genuine fibre tubes (not paper)

**COLORTOP PLUG FUSES**

America's Aristocrat of Plug Fuses

**TRICOMATIC FUSES**

With the thermal time lag cutout

**KLIPOK CLAMPS**

For fuse clips

**TEST CLAMPS**

For heavy-duty testing

**FUSE PULLERS**

Laminated for extra strength

**AUTOMATIC OILERS**

For all motors, line shafts, etc.

**TRY TRICO TODAY!**

TRICO FUSE MFG. CO., MILWAUKEE, WIS., U.S.A.

In Canada—IRVING SMITH LIMITED, Montreal

## TRICO

REG. U.S. PAT. OFF.

POWDER  
PACKED

## FUSES

STOP WASTED KILOWATTS AND WASTEFUL SHUTDOWNS

*In the News*

[FROM PAGE 70]

a membership corporation without capital stock. Incorporators are—John J. Kennedy, George J. Martin, Andrew A. Schroeder, Fred H. Newman, Stephen B. Fliegel, Satie M. Schroeder, Felix Henzel, George T. Stearns, Thomas G. Grady, Harry A. Collman and Frank B. Hughes, all of Albany, and Edmund G. May of Watervliet.

### COMING MEETINGS

**National Industrial Service Association**—The Palmer House, Chicago, Illinois. April 25-27.

**National Fire Protection Association**—Atlantic City, N. J., May 9-13.

**National Electrical Manufacturers Association**—Spring Conference, The Homestead, Hot Springs, Va., May 15-20.

**National Electrical Wholesalers Association**—Annual convention, The Homestead, Hot Springs, Va., May 22-26.

**New York State Association of Electrical Contractors and Dealers**—Big Moose, Adirondacks, N. Y., June 20-23.

### RANGES LEAD IN BIG KITCHEN CAMPAIGN

The Modern Kitchen Bureau has launched a comprehensive sales and advertising program for 1938. Upward of \$350,000 will go into the effort. While refrigerators and water heaters will be under the Modern Kitchen Bureau banner, the biggest push is directed to range and water heater promotion where wiring is involved. This program is sponsored by NEMA and the Edison Electric Institute jointly, and largely financed by manufacturers to further consumer acceptance of these three major appliances.

The promotion program includes national advertising to appear in six publications reaching over thirteen million homes. Other activities include a national "Spring Showing" sponsored locally by utilities and dealers, special 4-page newspaper sections for local groups, a window display contest, and a variety of sales and advertising helps. This is one of the most intensive and ambitious programs ever undertaken by the electrical industry, and the character of the material is fully up to the high standard set by the adequate wiring program.

### RURAL WIRING PROGRESSES

Latest REA progress reports estimate that 1,200,000 farms now have electric service, out of a total 6,800,000. This is roughly one in six farms. In 1937 the volume of construction was approximately \$55,000,000 for REA, while private utilities are estimated to have built 41,000 miles of rural lines.

With lines in operation or being constructed in some 40 states, the upswing in

The Jobs you **READ** about 



Scene from the Metro-Goldwyn-Mayer Picture, "The Girl of the Golden West", starring Jeanette MacDonald and Nelson Eddy.

## A FIVE STAR FEATURE!

JEANETTE MACDONALD ... NELSON EDDY ... and ...  
**TRIANGLE CONDUIT, WIRE AND CABLE**

With production costs at thousands of dollars per hour ... the power supply must be right! ... so Triangle products are used exclusively on the wiring installation for M-G-M Studios.

**TRIANGLE PRODUCTS REWARD BUYERS!**

**TRIANGLE CONDUIT & CABLE CO., Inc.**  
 Horace Harding and Queens Bldgs.  
 ELMHURST, NEW YORK CITY, N. Y.



**It MUST be right!**

**NEXT ISSUE**  
 TECHWOOD U. S. HOUSING PROJECT  
 ATLANTA, GA.  
 E. M. T. THIN WALL  
 CONDUIT INSTALLATION

## Modern Designs

By

**KNOX**



No. K-418



No. K-411



No. 5010

It is no longer necessary to use clumsy looking wireholders on a house. We have a streamlined size for every purpose.

Our new No. 5010 is reinforced with a steel U bolt which completely surrounds the hole, and will hold the wire suspended in case the insulator is broken. This type is now being specified on many R. E. A. jobs.

In addition to the numbers shown here we make other one point wireholders, and a complete line of two and three point housebrackets.

**ADEQUATE WIRING BEGINS OUTSIDE THE HOUSE**

*Samples and Prices Upon Request*

**KNOX PORCELAIN CORPORATION**  
KNOXVILLE, TENNESSEE



**FOR A  
PERMANENT  
TROUBLE-PROOF  
JOB**

**ALWAYS SPECIFY**

**CENTRAL**

### RIGID STEEL CONDUIT

Make a memorandum to use "CENTRAL" on your next job—the 12 point Rigid Steel Conduit that combines ALL the advantages of the perfect conduit including unusual wall thickness, greater tensile strength, balanced weight, standard threading, all of which give "CENTRAL" the maximum resistance to arcing, vibration or mechanical injury.

**CENTRAL TUBE COMPANY**  
PITTSBURGH, PA.

*"There's  
TESTED  
STRENGTH  
in  
EVERY  
LENGTH"*

*In the News*

[FROM PAGE 72]

loans to farmers for financing wiring and plumbing shows how rapidly the farmers are being put on these lines. Recent announcements from REA show the following allotments for loans to finance wiring and plumbing—

Arkansas, Pulaski County—\$9,000.  
Georgia, Bacon County—\$25,000; Douglas—\$5,000; Grundy—\$10,000; Lamar—\$5,000; Colquitt—\$10,000.  
Iowa, Buena Vista County—\$10,000; Grundy—\$15,000.  
Louisiana, Lafayette County—\$15,000.  
Michigan, Ingham County—\$8,000; Cass—\$15,000; Van Buren—\$10,000; Allegan—\$10,000.  
Minnesota, Stearns County—\$10,000; Dakota, \$12,000.  
Mississippi, Leake County—\$15,000.  
Nebraska, Polk County—\$5,000; Howard—\$25,000; Cuming—\$10,000.  
Wisconsin, Buffalo County—\$5,000; Dunn—\$15,000; Columbia—\$15,000.

### N. Y. INSPECTORS

#### HONOR BUSH

In appreciation of his fine cooperation with electrical inspectors, A. Lincoln Bush received a huge bronze plaque from the New York Chapter of the Eastern Section, IAEI at a meeting held March 7 in New York. A glowing tribute was paid to Mr. Bush by Nicholas J. Kelly, chief engineer of New York City's Department of Water Supply, Gas and Electricity. Mr. Kelly called Bush "the man of a few thousand words" who as head of past convention committees had made New York's inspector meetings a great success. Accepting the large bronze replica of an open book, Mr. Bush discussed the inspectors work and its vital importance to all branches of the industry.

### BOOK REVIEW

#### Arc Welding Handbook

"Procedure Handbook of Arc Welding Design and Practice", fifth edition, just announced by The Lincoln Electric Co., Cleveland, contains 1012 pages and a total of 1243 illustrations including photographs and drawings. The Handbook is a complete arc welding reference guide, written especially for designers, engineers, architects, production managers, welding supervisors and operators.

There are eight sections of the book covering: I.—Welding Methods and Equipment, II—Technique of Welding, III—Procedures, Speeds and Costs for Welding Mild Steel, IV—Structure and Properties of Weld Metal, V—Weldability of Metals, VI—Designing for Arc Welded Steel Construction of Machinery, VII—Designing for Arc Welded Structures, and VIII—Typical Applications of Arc Welding in Manufacturing, Construction and Maintenance.

Copies will be mailed, post paid, to any address in the United States for \$1.50 per copy.

*Electrical Contracting, April 1938*

# NEW

## FLOODLIGHTING UNITS MEET MARKET DEMANDS

New Hinged Door  
Totally Enclosed  
Powerful Beam  
Popular Price



• **Electrical Contractors** will find it to their advantage to get acquainted with these new Westinghouse units . . . and to tie in with the current floodlighting season. These units are especially suitable for floodlighting Commercial Buildings, Gasoline Service Stations, Sportsfields and Industrial Areas.

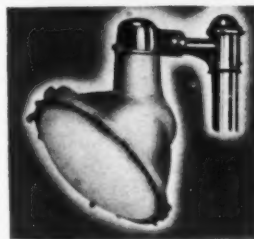
• **Hinged Door Cover** — Designed for easy servicing, these husky lightweights are equipped with a handy, cast-aluminum Hinged Door Cover, with heat-resisting lens. The new hinge arrangement takes the headaches out of installation and

maintenance. Required pressure for a dust-tight and weatherproof seal, is applied by four hook-bolts with convenient knurled thumb nuts. Reflectors are of Alclad spun aluminum, finished by the Alzak process.

• **Now is the time**, when ordinary demand-business is slack, for Electrical Contractors to tie in with Floodlighting for seasonal profits. Call your local Westinghouse Jobber for complete information on the new units and application data on current projects; or write to Westinghouse Electric & Mfg. Company, Lighting Division, Edgewater Park, Cleveland, Ohio.

**THERE IS A WESTINGHOUSE FLOODLIGHT FOR EVERY APPLICATION**

*AH Floodlights are available in 14-, 16-, and 20-inch diameters, with hinged door.*



*AVH Floodlights, furnished in 16- and 20-inch diameter reflectors, with hinged door are designed for vertical burning lamps, either mercury or incandescent.*

WHEN YOU THINK OF *Lighting Equipment* THINK OF



# Westinghouse

## "THE PERFECT LIGHT"

NEW HIGH  
QUALITY...  
POPULARLY  
PRICED...

To help you  
make more money



- This low-priced, competitive fixture for volume sales is attractive in appearance, has excellent illumination qualities, is easy to install, and is being widely approved.
- Carefully constructed—made of heavy gauge steel—switch easily installed in center—pull chain extends thru knob—reflecting surface aluminum sprayed for maximum efficiency—quickly attached to any outlet box or fixture stud—designed with bracket for instant assembly and adjustment—chrome finish.
- Investigate this truly modern unit now. It is made in four sizes. See your Wholesaler—if he is not yet ready to supply you, write direct to us—action on your part now will be a profitable move.

**THE GLEASON SALES COMPANY**  
35-37 S. DESPLAINES ST. CHICAGO, ILL.

## TAKE ADVANTAGE OF THIS SPECIALIZED SERVICE...

ORDER FROM  
**Headquarters**  
One Source of  
Supply for Wire  
and Insulating  
Materials  
Quality - Dependability - Service

This one source of supply is your answer when it comes to the purchase of wire and insulating materials. Here you get the finest quality products—here you can depend on one organization—here you get the quickest service on orders for any amount.

### JUST KEEP OUR CATALOG HANDY

If you haven't a copy, send for this new, free catalog—it makes ordering easy. It is an indexed catalog featuring the approved and widely used products we handle.

### HERE ARE 2 OF THE PRODUCTS WE SELL

**MAGNET WIRE:** We handle Essex wire—drawn and rolled from the best grade Electrolytic Copper rod stock. A complete stock of round and square magnet wire kept in stock. Rectangular sizes shipped from our Detroit factory just as promptly. Our catalog features this line completely.

**HOMER COMMUTATORS:** Standard or commercial—automotive—refrigerator, Century, Delco, Wagner. All products of merit, nationally known, widely used. When you need commutators we have the right quality—see our catalog which gives full details.

**INSULATION**  
INCORPORATED 2127 PINE ST., ST. LOUIS, MO.

### Add Those Extras

George Andrae of Milwaukee suggests a correction on the way the Herman Andrae Electric Co. charges for residence wiring. In February we lauded this industrial contractor's success in wiring houses for \$2.14 per outlet. George tells us we quoted him wrong. This price covers only the regular run of residence outlets. Additional charges are made for the service and ground, bell wiring, oil burners, stokers, etc., etc. Sorry George, but now that we admit our error and have your personal explanation, we hope it will impress a lot of men who should also be getting a profit for their work.



**NIAGARA LEAGUERS**—Here are some of the prime movers in the 1938 affairs of the Electrical League of the Niagara Frontier. Seated, Karr Parker, past president; Herbert I. Sackett, president; Richard Wable, secretary-treasurer; Samuel S. Vineberg, manager-secretary. Standing, Geo. J. Reichert, vice president; Karl L. Thielscher, executive committeeman; Robert D. Glennie, vice president. The league conducted more activities during 1937 than in any previous year, had more income and greater expenditures, but added a small sum to its surplus account.

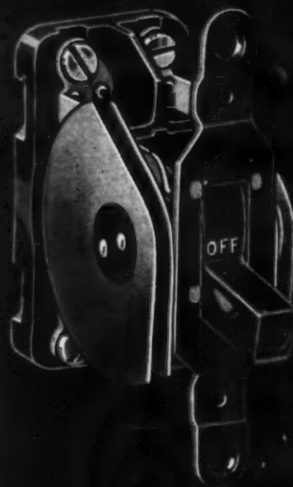
### No Junk for Mueller

Otto J. Mueller, one of Philadelphia's pioneer industrial contractors wants everyone to know that the Mueller Electric Co. has no patience with junk wiring materials. He was quoted in our March issue on this subject with reference to the practice of a local residence contractor. But it is he (not Mueller) who ekes out a meager living on range wiring, taking in the old salvaged service materials for his profit.

### Jones' of New Brunswick

The electrical fraternity of St. John, N. B., Canada includes three Jones brothers, all contractors running their own firms. There is Robert F. Jones, a veteran of local amateur dramatics and of softball. Next we have Frank Jones, then John B. Jones, who uses the firm name of the Jones Electric Company.

# ARROW-H & H



## Small Motor Starting Switches

*Across-the-Line Type* Tumbler Switches, without overload protection... Give positive control for motors; especially suitable for oil burners, refrigerators, motor-driven machinery and lighting loads.

These switches have rugged, durable mechanisms built to perform with the sturdy integrity characteristic of Arrow-H & H Lines. Bakelite arc snuffers increase breaking capacity; kick-off release mechanically starts the switch blades in motion and prevents sticking; extra-heavy blades and contact jaws increase current-carrying capacity.

Different styles of mounting are supplied for a wide range of machine-design requirements. Separate switch units are available for installations in switch housings built into motor-driven machinery.

No. 6808 (upper right) is a double-pole switch for single phase motors; No. 7808 (lower left) is 3-pole for 3-phase jobs. Also, the line includes 3-way, 4-pole and 2-speed reversing switches. All have horsepower ratings... Everything you may need in this line will be found in Motor Starting Switch Catalog No. 7 — on request.

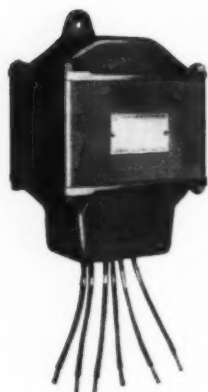
SOLD THROUGH YOUR

**ARROW ELECTRIC DIVISION**

ELECTRICAL WHOLESALER

THE ARROW-HART & HEGEMAN ELECTRIC CO. HARTFORD, CONN.

# SCRATCH that excess power cost off your books



**G-E** AIR-COOLED transformers have enabled many plant managers to operate 115-volt power tools from power circuits of higher voltage, thereby scratching off the books the cost of long separate low-voltage circuits. These transformers can help you, too. They can be installed at any point in your plant to step down the power-circuit voltage, for low-voltage power purposes, and—where permissible—for lighting. For complete information write to General Electric, Schenectady, N.Y.

**GENERAL ELECTRIC**

**FLOOR BOXES and**



**No. 130 "LATROBE" ADJUSTABLE WATERTIGHT FLOOR BOX**

No. 130 Box with No. 207 Bell Nozzle. Cut-away view illustrates how tapered unit receptacle fits tapered opening in adjustable ring. Design eliminates many small parts. Cover plate  $3\frac{1}{4}$ "—overall height  $3\frac{1}{4}$ ".

**WIRING SPECIALTIES**



**No. 110 "LATROBE" WATERTIGHT BOX**

Cut-away view of No. 110 Box showing how the tapered unit receptacle fits tapered opening in top of box body. The last word in design, appearance, and simplicity of installation.

Sell and install **LATROBE**—the complete line for residential, commercial and industrial work. Catalog on request

**FULLMAN MFG. CO.**  
LATROBE - PENN.



**No. 284 DUPLEX RECEPTACLE NOZZLE**

With  $\frac{1}{2}$ " brass pipe extension. Neatest and most compact fitting obtainable. Also available with  $\frac{3}{4}$ " pipe extension. Fullman also offers Duplex Telephone Nozzles.



## Quick Settlements

H. T. Brown, of the Brown Electric Co., Trenton, N. J., scoffs at long drawn-out labor sessions. He recalls an old method in Trenton, whereby the joint labor board, comprising two contractors and two employees would call in the first person they could find outside the meeting place to render a tie-breaking, disinterested vote.

## Two Extremes

Visiting the spacious lighting display rooms of Edwin C. Lewis, Inc., in Boston creates an impression of specialization in better homes service. Little is evident that this company engages in Boston's big jobs, such as the towering court house project that is now taking form.



**LIGHTING MERCHANTS**—Contractors can sell good lighting but they need to display their wares, believes W. P. Neblett (right) proprietor of the Baile Electric Co., Norfolk, Va. He has been doing a good job in the sale of commercial and industrial units to augment the construction volume. T. J. Burns, Jr. sell too, and keeps a weather eye on the arrangement of the displayed items.

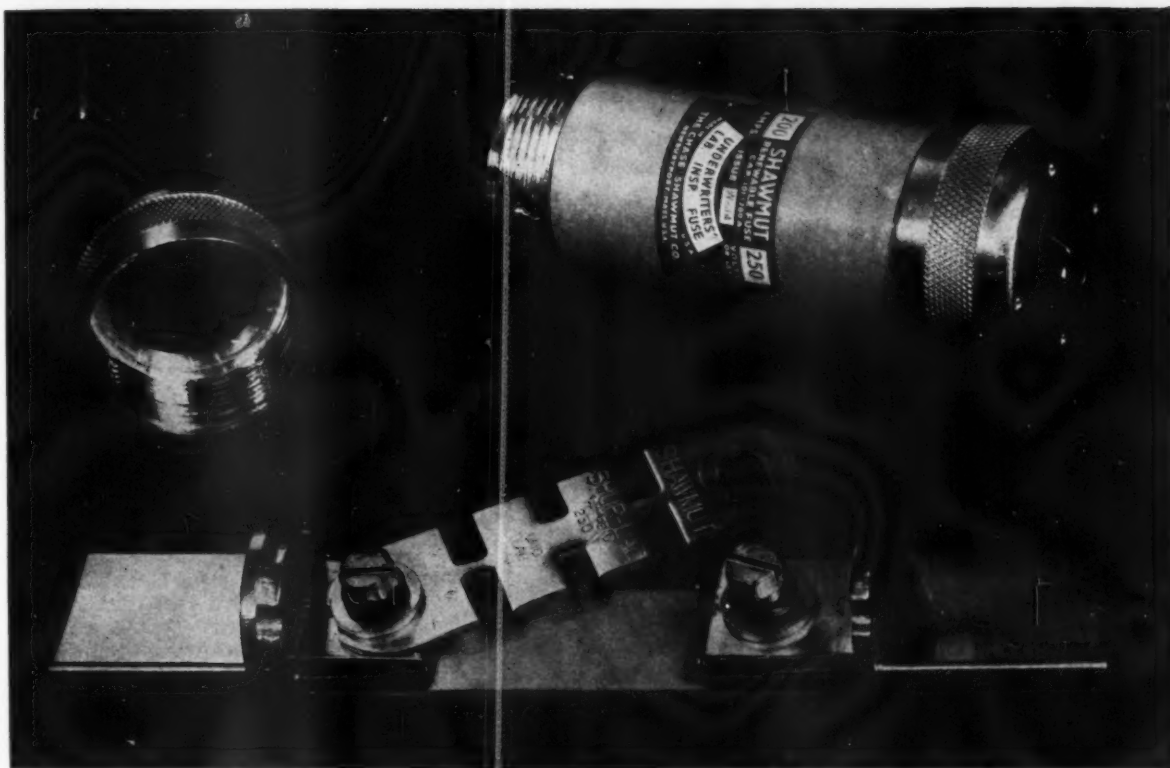
## Hands-off Policy

Because so many things can cause refrigeration motors to break down, E. H. Kotz of the Electrical Motor Repair Co. of Trenton, N. J., will not allow his shopmen to install the belts on repaired motors taken back to the customer. He requests the customer to have the refrigerator service check up all mechanical conditions and then attach the motor.

## Another Trick

Down in Albuquerque, Dr. C. B. Austin recently wired his new bungalow. He added a touch worth including in any house job. Beside the front door bell button is a pilot light that signals if any lights are burning in the house. When the family steps out and closes the front door, this tells them if they have forgotten to turn off any lights. But they do not have to go back in and hunt for them. There is a switch beside the pilot outside the front door, that will turn off all lights inside. The Austins have an all electric home.

*Electrical Contracting, April 1938*



**SO** SIMPLE that you can take it apart or put it together instantly, after once looking at it. You only have to remove one cap, and loosen two screws, to replace the link. And you can put it together only **ONE** way — the **RIGHT** way. Then you are back in circuit again — there are no costly shutdowns, with men and machinery idle.

**SO** STURDY that every part meets the strictest requirements of performance and durability. The simple construction enables every part to be made more efficient, more serviceable, and more useful.

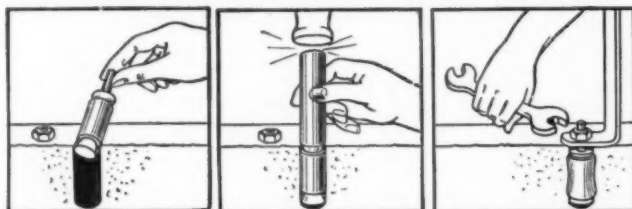
**SO** RELIABLE that they give **COMPLETE PROTECTION** under all conditions. Fewest parts; strongest construction; easiest and speediest renewal; proper time-lag to prevent needless blowing, yet to forestall damage, immediate or cumulative. And the price is no higher.

# SHAWMUT SHUR-LAG RENEWABLE FUSES

*Approved by Underwriters' Laboratories*

*The* **CHASE-SHAWMUT COMPANY • NEWBURYPORT • MASSACHUSETTS**  
*Fuse makers since 1893*

# PAINE LEAD ANCHORS THREE EASY STEPS



1. Place the anchor in the hole. Drilled to size and depth. 2. Set anchor with a few sharp taps on tool supplied free with anchors. 3. Place work in position. Tighten with ordinary wrench.



Fig. 910

**Fig. 910**  
**Bolt & Nut type**  
... a bolt, a nut, a lead sleeve and a lead cone. Cone is finned. Prevents turning in sleeve. Bolt and nut are Cadmium plated.

**Fig. 900**  
**Machine Screw Type**  
... a brass cone (knurled to eliminate turning while being tightened) and a lead expansion sleeve. Cone is countersunk for easy entrance of machine bolt or screw.



Fig. 900

**ADVANTAGES.** As strong and enduring as the bolt or the material they are set in. Require no special skill—no exact alignment of holes. Rust proof, jiggle proof and vibration proof. The most satisfactory anchor for their innumerable purposes ever invented.

**FOR A SOLID, SECURE and PERMANENT ANCHORAGE of Electrical Apparatus IN STONE MARBLE GLASS MOSAIC BRICK CEMENT TILE and similar materials**

**SEND**  
PAINE has a swell new book—METAL SPECIALTIES FOR INDUSTRY. Send for a FREE copy today.

## THE PAINE CO.

Dept. 584, 2947 Carroll Ave., CHICAGO  
79 Barclay Street, NEW YORK



**Do you want to show your customers that you do first class work?**

**START WITH GOOD MATERIAL AND FINISH WITH A TEST—USE A MODEL "DM" MEGOHMMER**—the instrument with a scale like a tube tester, grading insulation as "GOOD," "FAIR" or "DOUBTFUL."

**USE THE COUPON FOR FULL DETAILS OF A NEW PLAN FOR INCREASING YOUR BUSINESS AND BUILDING GOODWILL**

**HERMAN H. STICHT & CO.**  
Dept. 53, 27 Park Pl., New York

Send full details of your business increasing plan ☐

Name .....

Firm .....

Address .....

## NEW SCOTT TAPERED FISH WIRE for "Scott-free" fishing!

Here is the first and only improvement in FISHWIRE ever offered the electrical industry. **EXTREME FLEXIBILITY** of patented tapered end permits easy passing around all bends, with no wedging.  $\frac{1}{8}$ ,  $\frac{3}{16}$ , and  $\frac{1}{4}$  x .060, in 50, 75, 100, 150 and 200 foot coils. A great time, trouble and money-saver.

1. Ordinary fishwire. Lack of flexibility prevents easy pushing through.
2. Extreme flexibility and tapered ends lead Scott Fishwire around all bends with ease.



**THE RATTAN MANUFACTURING CO.**

552 STATE STREET  
NEW HAVEN, CONN., U. S. A.  
GENERAL SALES AGENTS HATHEWAY AND CO.  
229 CHURCH STREET NEW YORK, N. Y., U. S. A.

## Modern Motor Test Methods

[FROM PAGE 15]

the large d.c. generator. Full field is applied and then the armature voltage is raised and the motor started. Watching the instruments, the voltage is brought up to full value and the speed is checked with a portable tachometer. Armature volts, armature amps., field volts, field amps. and r.p.m. are recorded.

If the motor is adjustable speed, the field is weakened until the motor is running approximately 20 per cent over speed, then strengthened again to rated speed and field and armature data are recorded. Armature voltage is reduced to zero, field voltage is reduced to zero and the field circuit is opened. Then, if the machine has series or commutating windings, armature current is increased till the armature begins to turn slowly and rotation is noted. If the motor runs the same direction as before, the series fields are properly connected for a motor. If it runs opposite they are proper for a generator. While the armature is turning slowly the interpoles and main poles are checked with a compass for proper relationship. Non-commutating pole machines have to go on a dynamometer for proper brush setting.

## Converters

Converters, inverters, and m.g. sets are tested under load, up to the capacity of the equipment, by loading back one end of the converter into the corresponding end of the testing m.g. set. If the machine under test is being run from the a.c. end, with equal d.c. voltages on the testing machine and the machine being tested, no current flows and there is no load on the machine being tested. By reducing the voltage of the test machine, the machine being tested is loaded and all controls and instruments, both a.c. and d.c. are at the operator's finger tips.



**YOU'VE GOT SOMETHING HERE!  
AND IT'S EASY TO SELL**



## **THE DOME DIFFUSER**

**UNIFORM ILLUMINATION ENDS EYE FATIGUE**

● You'll find a real need for this new fixture among your customers. Suggest it wherever work demands accuracy, such as for inspection departments, laboratories, textile shops, etc.

The new Goodrich Dome Diffuser, using bowl-silvered lamp, produces a soft, well-diffused illumination which shows up mi-

nor details without eyestrain. Much of the light which is ordinarily wasted in the neck of the lamp, is directed toward the ceiling, thus eliminating sharp contrasts and brightening up the whole interior.

This scientific distribution of light saves time and saves money by saving the eyes of workers. Tell your customers about it.



### **"AND THIS CHOICE OF MOUNTINGS ANSWERS EVERY NEED"**

"In addition to the Hevyduty threaded hood shown above, the Dome Diffuser is also furnished with the Goodrich Diskonect hood—a simple, snap-on snap-off device which permits removal of reflector and lamp as a unit. That makes it easy to install, easy to clean—easy to sell. For full information, ask us to send you a catalog sheet on the Goodrich Dome Diffuser."

*Sunny Lumens*  
THE GOODRICH REFLEXPERT

# **GOODRICH**

## **ELECTRIC COMPANY**

OFFICES IN ALL PRINCIPAL CITIES

GENERAL OFFICES      FACTORY, 2902 NORTH OAKLEY AVENUE, CHICAGO, ILLINOIS

*Electrical Contracting, April 1938*

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# About NECA

## LABOR RELATIONS COMMITTEE MEETING

The date for the NECA Labor Relations Committee meeting has been set for the week of April 11th at the Hotel LaSalle, Chicago, Illinois.

Groundwork for the labor relations plan to be prepared by this committee is being laid by exchange of correspondence between the members of the committee and through letters sent out by the committeemen to NECA membership within their respective divisions.

## REPORTS FROM NECA COMMITTEEMEN

### Unemployment Insurance

**Chicago, J. N. Pierce:**—I have had several requests from our National members relative to the method of handling the unemployment insurance under the Social Security Act. Most of these involve the question of how to report men who are working for contractors intermittently in two or more states. The Labor Departments of these several states have been consulted and it is the consensus of opinion that the unemployment insurance returns should be made on all men to the Labor Department of their resident state. In the near future there will be reciprocal arrangements made between the states for definitely handling the matter.

For the present, it would be well for contractors to secure from the Labor Department of each state in which they work information as to how the matter should be handled. The flood of questions which are being received by these Departments are such that it seems almost impossible to receive an answer to letters, therefore I would suggest that unless you receive prompt answers to your letters, a personal visit be made to the Department for the desired information.

### Apprentice Training

**Chicago, J. W. Collins:**—The Apprentice Training Committee of the Department of Labor, which was formulated some two months ago, has not held a meeting for the purpose of outlining the national program for building trades apprentices. However, the Department has gathered together all information on the subject that may be gained from different cities throughout the country. It was the general practice and suggestions from em-

ployers and employer organizations as to what might be considered the most satisfactory method of developing a universal program.

The Federal Committee was scheduled to meet in Washington the latter part of March for the purpose of reviewing the work already done by the Department. A general program will be worked out in detail in Washington through the work of several field men who are now studying the matter.

### Seattle Facing Labor Readjustment

**Seattle, S. G. Hepler:**—Seattle for years has been free from labor disturbances within the building industry. Some months ago the building trade crafts requested a readjustment "upwards" of the entire wage structure. The request was met by the employers with a counter request for an eight hour day, 40 hours per week for eight months of each year with a six-hour day to prevail during the winter months and with NO increase or reductions in the hourly rate schedule.

The six-hour day was inaugurated in the early days of the depression in an attempt to spread employment by mutual agree-



**HAPPY DAYS**—Quality construction jobs seem to find their solution when this happy Quebec pair take charge. Emile E. Goulet (right) and F. N. Sackman keep Goulet, Ltd., crews busy with big work, such as the \$100,000 wiring job at Camp Val Cartier, the new Dominion of Canada arsenal. Mr. Goulet, during 30 years in the city of Quebec, has a long list of large public and commercial buildings to his credit. Mr. Sackman is a transplanted Brooklynite, coming to Canada in 1912 after leaving the big city in 1905 to handle some large jobs in South America for the L. K. Comstock Co. In addition to Sackman's keen insight as to electrical engineering and design, he also found a bride in Canada, and as evidenced, has remained happy thereafter.

ment. The general value of this plan has been for sometime subject to criticism. Recently it has been severely attacked in the press and by financial people in particular as tending to increase building costs materially.

As always happens, the contractor groups are caught between the two factions. On one hand they are accused of hindering reemployment, on the other hand they are accused of conniving with labor, thus forcing higher costs.

The negotiations as between the two groups reached a deadlock February 28th. Under the terms of the existing labor agreement, wherein an arbitration clause prevailed, the employers invoked its provisions by calling upon the Federal Mediator on March 2nd. The Mediator after several separate meetings with both sides, called both parties into a combined meeting and suggested arbitration. The employers readily agreed. The labor group reserved its decision until March 11th. In the meantime all construction work involved is at a standstill.

### Kansas City Chapter Promoting Adequacy

**Kansas City, H. C. Evans:**—Justly proud in being sponsors of the first local link in tying-in with the National Adequate Wiring Program, the Kansas City Chapter, NECA, looks confidently into the future of adequate wiring. Weeks of actual planning culminated in a nine-page outline for presentation to other branches of the industry. This was purposely withheld until a representative of the National Adequate Wiring Bureau presented the National Program at a local industry meeting, after which our local program was presented, to utility officials, February 22nd, and met with their entire approval.

The first link in the program is based on merchandising additional outlets to existing homes. Selling prices have been established on twenty-odd types of outlets, convenient terms of payment, newspaper advertising schedules, selection of sixty sales-solicitors, sales training course, sales demonstration kits and portfolios, individual dual sales territories arranged and commissions and advertising appropriations agreed upon.

After proper training, solicitors, with their assigned territories of about a thousand homes, in the immediate vicinity of their residence address, are to be employed by Qualified Electrical Contractors, only—an equal number of solicitors being assigned to each contractor. In general, Senior High School students are being selected and trained in mass. Newspaper advertisements will carry the names of all participating contractors, the expense of which is being borne equally, based on sales, by the utility and contractors. Based on a most conservative estimate, there is a market for over a million dollars, in additional outlet wiring only, which should permit of at least six to eight, three to four column, 10-inch ads a month. The cost of this program is based on accruals of 10 per cent of actual sales in which the contractor and utility share alike.

The type of wiring is to be strictly in

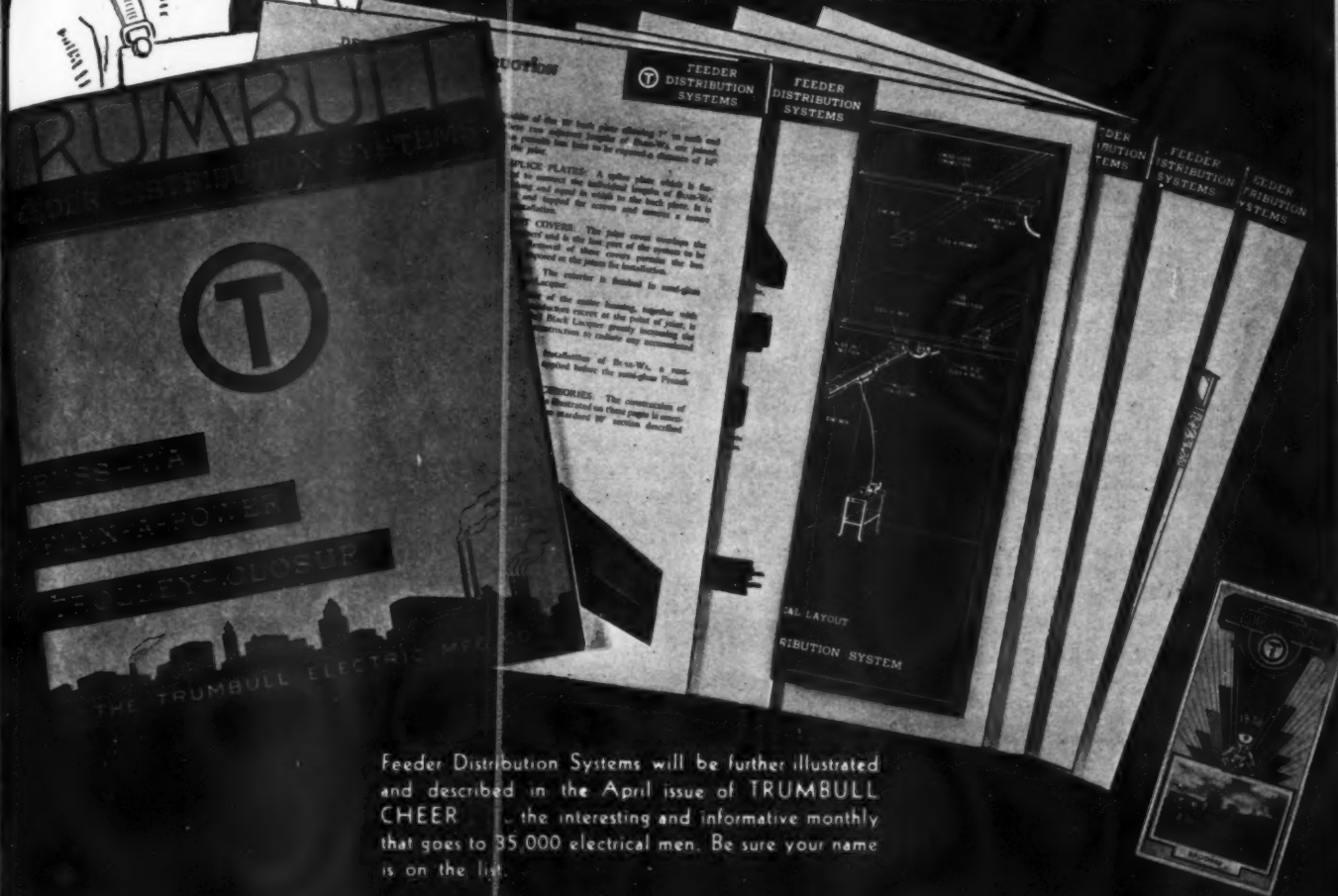
# Feeder Distribution Systems

**BUSS-WA . . . FLEX-A-POWER . . . TROLLEY-CLOSUR**



"THE NEW TRUMBULL FEEDER DISTRIBUTION BULLETIN brings you right up-to-date on today's most important development in electrical distribution system methods . . . describes the use and application of BUSS-WA, the enclosed bus bar system for heavy duty feeders — FLEX-A-POWER, the "convenience outlet" for power in industry and TROLLEY-CLOSUR, for supplying power to portable tools and machines . . . shows how and why these accepted Trumbull systems simplify plant layout and reduce maintenance costs.

There are 36 pages of detailed description, photographs and engineering data in this bulletin. A postcard or letter will bring your copy by return mail."



Feeder Distribution Systems will be further illustrated and described in the April issue of TRUMBULL CHEER — the interesting and informative monthly that goes to 35,000 electrical men. Be sure your name is on the list.

**The TRUMBULL ELECTRIC MFG. CO.**

# SAVE Time and Money with Greenlee Tools



## Hydraulic Conduit Benders

Greenlee Hydraulic Benders are time and money savers, because they bend conduit quicker and easier than by other methods. In addition, they make smooth, even bends, eliminating many fittings and making it easy to pull in wire and cable. They are simple to operate and are readily portable.



## Knockout Tools

Greenlee Knockout Punches and Cutters are time savers and profit makers, because they make it easy to enlarge holes in switch boxes, cabinets, etc. They form clean-cut holes quickly and accurately, without reaming or filing.

## Other Greenlee Tools

Hydraulic Pipe Pushers    Joist Borers  
Bit Extensions    Electricians' Bits

Let us send Complete Information

**GREENLEE TOOL CO.**  
**ROCKFORD                      ILLINOIS**

Greenlee Tool Co., Rockford, Illinois

Please send complete information on:

☐ Knockout Tools    ☐ Conduit Benders

Name.....

Street.....

City.....

State.....

My Jobber is..... EC-4-38

## About NECA

[FROM PAGE 82]

accordance with new code requirements, and material and workmanship is guaranteed to measure up to the highest standards. Much credit is given to NECA. Floating its banners, this Chapter is confident of cooperation and support of the utility in this and other similar local activities.

## Southeastern Contractors Adequately Minded

*Birmingham, D. B. Clayton:*—As a result of the presentation of the Plan of the National Adequate Wiring Bureau in the Southeast during the latter part of February and the first week in March, by the Field Representatives of the N.A.W.B., several local groups have already started to promote Adequate Wiring.

The Memphis group is making plans to push this program, and should show results within the next two months. The state association of Florida contractors agreed to start plans in their major cities and by mid-summer should be functioning effectively. Atlanta contractors are set up to proceed with this plan at once, having an active local group. Columbus will follow suit. The North Carolina state association on February 25th heartily approved the plan and will proceed as fast as possible to set it up in the larger cities.

Birmingham has had an Adequate Wiring Committee for a year and has been successful in preparing plans for adequacy in new homes. This Committee is ordering material from the National A. W. Bureau and will proceed with this work more actively. The Electrical Association of Birmingham will ask for a license to use the Certification Plan, thus carrying the Plan through to its final detail.

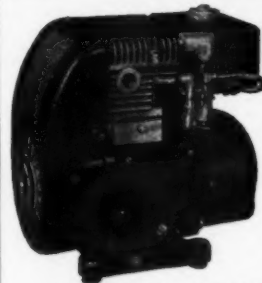
## Canadian Membership

*Toronto, G. W. Patterson:*—The 1938 NECA membership campaign just released in Canada is bearing results already. The increasing number of contractors from all across Canada, who are taking advantage of membership in National Electrical Contractors Association shows the interest aroused in National membership. The praises of the many services of NECA are perpetual.

A Canadian contractor who joined NECA recently, after receiving the Association services to members, stated he never received so much for his money, and more than got back value for his dues in the first shipment of NECA services, and felt assured that the yearly services were of extraordinary value.

Material for this department is supplied by the headquarters staff of the National Electrical Contractors Association, 420 Lexington Avenue, New York.

## Complete Electric Plants



**NEW  
1938  
Models**

### A UNIT FOR ANY PURPOSE

In the COMPLETE LINE OF ONAN ELECTRIC PLANTS are AC and DC types, 6, 12, 32 and 118 volt, also AC-DC Combination Units. Sizes 350 to 5000 watts to meet the requirements of THOSE WHO MUST PROVIDE THEIR OWN ELECTRICITY for FARMES, SUMMER CAMPS, COTTAGES, BOATS, COMMERCIAL PURPOSES and STANDBY SERVICE. Run on Gasoline, Gas or Kerosene.

### OPERATE HOUSEHOLD APPLIANCES

RADIO, WATER PUMP, MOTORS—anything that normally would operate from city lines. WILL RUN PUBLIC ADDRESS and SOUND CAR EQUIPMENT. The sale of an Electric Plant calls for WIRING, FIXTURES, APPLIANCES which mean additional profit.

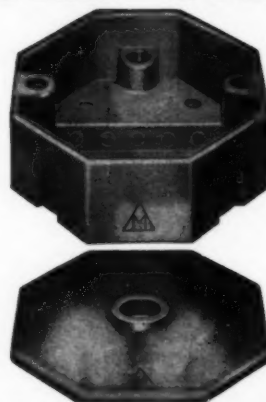
### WRITE FOR DETAILS ON

Liberal Dealer's Proposition and territory assignment.

**D. W. ONAN & SONS'**

1296 ROYALSTON AVE., MINNEAPOLIS, MINN.

## Profit by USING ILLINOIS Dependable Porcelain OUTLET BOXES



\*Glazed and unglazed styles conforming to all existing standards of dimensions, spacing, position of knockout holes, and mounting screws. High mechanical and electrical efficiency. Contractors who use these products not only establish themselves most securely with their customers but also build their business by making each job a true quality one. Send for bulletin.

**ILLINOIS ELECTRIC PORCELAIN CO.**  
MACOMB, ILL.

**FIRST AID FOR  
HOT WEATHER NERVES!**

**GENERAL  ELECTRIC**

*Super-Quiet Fans*



**AMAZING, NEW G-E  
SUPER-QUIET FAN**

The world's champion breeze maker! Moves tremendous volumes of air at high velocity, and with extremely quiet operation, due to revolutionary new G-E Vortalex Blades—an exclusive General Electric development. It pays to stay with the leader!

**THE "MAINLINE" AND  
PROFIT LINE FOR 1938!**

Tie in with G-E Fans for 1938 and get your share of the profits that General Electric Fan Dealers will enjoy! You'll have four lines of fans—Super-Quiet, Quiet, Standard and Junior—and brilliant new sales and advertising helps featuring a brand new "HOT WEATHER NERVES" consumer approach!

The salesman of your local G-E Fan Distributor has the facts in a new portfolio entitled, "THREE GOLDEN REASONS WHY YOU WILL PROFIT WITH GENERAL ELECTRIC FANS." Ask to see it! You'll profit by it!

Appliance and Merchandise Department, General Electric Company, Bridgeport, Conn.

**GENERAL  ELECTRIC**

# WITH THE

## P. C. Tiedeman Dies

Perry C. Tiedeman, retired vice president of the Standard Electric Stove Company, died in St. Vincent's Hospital in Toledo, on February 25.

R. C. Purdy has been added to the sales staff of the Detroit office of the McGill Manufacturing Company of Valparaiso, Indiana. Mr. Purdy will be located in Cleveland and will cover Akron, Canton, Youngstown and Warren, Ohio.

Brown Company of Portland, Maine, announces the transfer of the executive offices of its Tubular Products Division, which includes all Bermico Fibre Products, to the company's offices in the Graybar Building, 420 Lexington Avenue, New York City.

The Sangamo Electric Company of Springfield, Ill. announces the appointment of Harry W. Wittenburg as district manager in Los Angeles, succeeding the late J. G. Monahan. He was formerly assistant district manager in this branch office.

C. A. Russell, formerly manager merchandising division, has again resumed responsibilities of general sales manager for the entire Wesix Electric Heater Company organization. This company is located at 390 First St., San Francisco, Calif.

## Mercoird Personnel Changes

At the annual meeting of the Mercoird Corporation, Hugh Courteol was elected president. He has been associated with General Motors for the past 18 years. I. E. McCabe, who has been chief engineer of the company since its beginning, is now chairman of the board of directors.

J. W. Owens has been made executive vice president in charge of sales. R. H. Chadwell was elected treasurer and Thomas P. Crawford as secretary.

## A New Company

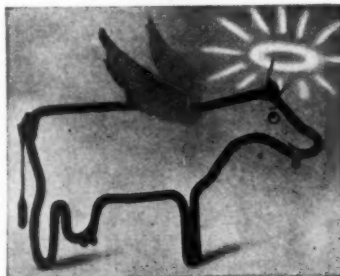
Polaroid Lighting, Inc., is the name of the new company which has been organized to develop the market and promote the use of the new light controlling material, Polaroid. Headquarters are in West Haven, Conn. and the company will be headed by Walter Lown, former director of sales of the Greist Manufacturing Co.

The Polaroid Corporation has acquired control of all patents relating to light polarizing material and to the use of polarized light in eliminating automobile headlight glare formerly held by Dr. L. W. Chubb and his associates in Polarized Lights, Inc. Dr. Chubb is director of research of Westinghouse Electric & Manufacturing Co.

The McGraw Electric Company moved into its recently completed industrial plant at Elgin, Illinois. The factory building contains approximately 100,000 square feet of space on one floor. Administrative quarters will be maintained in a two-story brick building.

Cutler-Hammer, Inc. of Milwaukee, has moved its Cincinnati office to the American Building, Central Parkway at Walnut.

Tork Clock Company, Mount Vernon, N. Y. has announced the appointment of V. G. Christiansen Sales Co., 1107 Farnam St., Omaha, as district representative in Iowa and Nebraska.



*SOME THINK the manufacturers should quit making Old, No. 14. They can't do that. But smart contractors can quit installing it for branch circuits. It is too small now.*

## Westinghouse Changes

A Special Products Division has been formed at Bloomfield, N. J. to cover the design, manufacture and sale of electronic tubes. H. J. Hoffman will head this Division.

J. K. B. Hare has been appointed central district manager. John Andrews, Jr., former district manager, joins the headquarters staff of the company as assistant to the vice-president in charge of sales. He will retain his offices in Pittsburgh.

The Industrial Department has been divided into three new departments, Industrial, Resale and Industry Engineering. C. B. Stainback has been made manager of the Industrial Department, Bernard Lester, manager of Resale and C. A. Powell, manager of Industry Engineering. These departments are all located at East Pittsburgh, Pa.

Signal Electric Co. of Menominee, Mich. has just completed and is now occupying a new addition to its factory. It is a two-story building, providing 22,500 more square feet of floor space.

J. Harold Hawkins has been appointed consultant to the General Electric Home Bureau. For the past three years he has been architectural editor of McCall's Magazine, and previously editor of Ladies' Home Journal.

The Porcelain Enamel Institute of Chicago has appointed Charles S. Pearce secretary to fill the position vacated by George P. MacKnight.

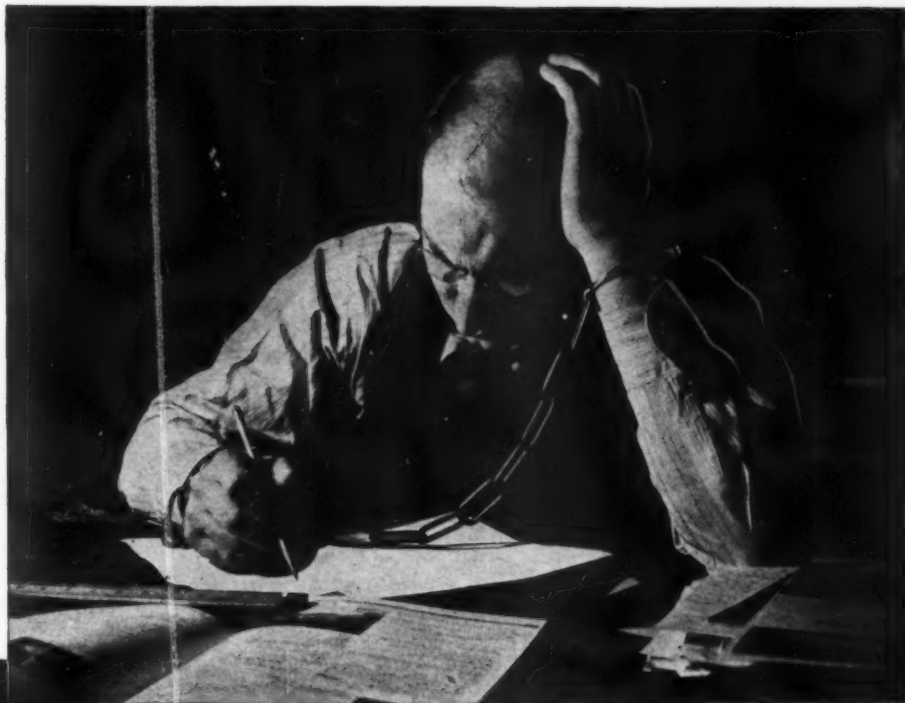
American Steel & Wire Co. of Cleveland announces the appointment of Frank J. Carr as assistant to the president.

B. Hartman, formerly at 168 Sunset St., Long Beach, Calif., has moved to new and larger manufacturing headquarters at 708 West Esther St., Box 708 West State St.

Fairbanks, Morse & Co. has opened a display room on the first floor of its building at 600 S. Michigan Ave., Chicago.

Schwarze Electric Company of Adrian, Michigan, has purchased the manufacturing business of Stanley & Patterson. The New York office will be continued at 150 Varick Street and will be operated as Stanley & Patterson, Division of Schwarze Electric Co. Ralph M. Cohen, Manufacturers' Distributing Co. of 339 Broadway, New York, will continue as eastern sales representative for Schwarze and will also handle the Stanley & Patterson line for the same territory.

# FREE YOURSELF.... FROM LIGHTING PROBLEMS!



## LET PERMAFLECTOR ENGINEERS SOLVE THEM..

Your time is too valuable to spend solving knotty lighting problems. You need more time for selling—more time for the numerous complex problems of your business.

Unchain yourself from this burden by sending your lighting problems to Permaflexor engineers. These well-trained lighting experts await your command to step forward and help you with blueprint suggestions based upon their many years of varied lighting experience.

Send complete information on your jobs direct to Pittsburgh or, if you prefer, to your local Permaflexor representative. You will receive complete layouts that will solve the problems efficiently and please your customers instantly.

## PITTSBURGH REFLECTOR CO.

*Permaflexor—the silvered glass reflector with the permanent reflecting surface.*

Pittsburgh  
Pennsylvania



Representatives  
in 28 Cities

# PERMAFLECTOR

*Lighting*

PERMAFLECTORS • LUSTROLIERS • LUMINAIRES • SPOTLIGHTS • URNS  
FLOODLIGHTS • LAMPS • BUILT-IN CEILING UNITS • ACCESSORIES

PITTSBURGH REFLECTOR COMPANY EC-4-38  
OLIVER BLDG., PITTSBURGH, PA.

Please send me complete information on Permaflexor lighting equipment and details of your free engineering service.

NAME .....

STREET .....

CITY ..... STATE .....

# SORGEL AIR-COOLED Transformers for Contractors Who Want More Business

Industrial and commercial institutions are always ready to be shown how they can save money, reduce costs, and step up efficiency, by supplying 110 volts for lighting, portable tools, heating devices, appliances, from 220, 440 or 550 volt A. C. power circuits, with SORGEL Air-Cooled Transformers.



The reason SORGEL Transformers can be installed easily and economically in any convenient place inside of buildings, or right where the change of voltage is wanted, is because they're Air-Cooled. No enclosures or fire-proof vaults needed. No oil. No upkeep. Approved by Underwriters.

Stock sizes 1/4 to 50 Kv-a.

Larger sizes and special types built to order quickly

Write for literature with diagrams and prices

**SORGEL ELECTRIC CO.**

No. Plankinton Avenue Milwaukee, Wis.



[FROM PAGE 86]

Burg Electric Sales Co., Inc. has moved from 530 Arch Street to 310 S. Fourth Street, Philadelphia, where it will occupy an entire building, with 32,000 square feet.

Allen B. DuMont Labs, Inc. of Upper Montclair, N. J., has announced the appointment of Vernon C. McNabb as sales representative for the Indiana and adjacent territory. Mr. McNabb's headquarters will be 5105 N. Capital Ave., Indianapolis, Ind.

The General Electric Company and the General Electric Supply Corp., together with affiliated companies, recently moved to a new building at 212 North Vignes St. in Los Angeles. The Supply Corporation's Los Angeles branch Southern California district offices are also there, covering the trade area of Arizona, Southern California and part of Texas. And this is one of the largest electrically heated buildings in the territory.

W. C. Lipe, Inc. of Syracuse, N. Y. has purchased the lathe division of Porter-Cable Machine Company. The new ownership is continuing the production of the entire Porter-Cable line. Porter-Cable Machine Company will now concentrate all production facilities on its line of portable tools for wood-working.

Milton G. Smith was recently appointed Eastern district sales agent for Enameled Metals Company. His territory includes New York State from Albany south, Connecticut and part of New Jersey. Mr. Smith's headquarters are at 295 Madison Ave., New York City.

## Personnel Changes

The Bunting Brass & Bronze Company of Toledo, Ohio has announced the following changes in its sales staff personnel and locations of branch establishments—

William C. Bracken has been appointed to the southeastern area, with headquarters at 296 Ivy St., N.E., Atlanta, Ga. In Los Angeles, Calif., the company is consolidating its heretofore separate automotive and industrial products warehouses in one large sales and service plant at 240 West 18th St. I. Eldred, formerly in charge of the Bunting Kansas City offices, will supervise this branch.

Allan Hasty of the Toledo office will replace Mr. Eldred in Kansas City.

## 2 NEW FEATURES No Added Cost

### AUTOMATIC Synchronous TIME SWITCH

Manual control and cutout add much to its value. Installation is simple—trip levers are easily set. There are no delicate or intricate parts to adjust. Made in single pole and double pole. Contractors should investigate—Write for circular.



Automatic Electric Mfg. Co.  
MANKATO, MINN.

## HERWIG

### OUT-DOOR LIGHTING FIXTURES

Apartment Buildings  
Public Buildings  
Bungalows  
Churches  
Schools  
Garages  
Country Clubs  
Warehouses  
Residences

### A FIXTURE FOR EVERY OUTDOOR PURPOSE

Cast Iron or Bronze

Send for our

**Catalogue No. 40**

260 Illustrations

The  
**Herwig Company**

MANUFACTURERS  
Established 1908

1753-59 Sedgwick Street  
Chicago, Illinois, U. S. A.

Modern Numbers Shown on P. 4 & 5  
—Also Furnished in Cast Aluminum  
—Polished or Satin Finish

## FOR PROFITABLE AND EASY-TO-SELL WIRING JOBS

# Check these features of **PORCELAIN**

**KNOBS • TUBES • CLEATS  
• OUTLET and SWITCH BOXES •  
Many Other Insulating Items**



» Recognized as the safest, most nearly permanent and trouble-free wiring system, it insures satisfied customers and later repeat orders.



» Contractor makes more profit on each job—yet consumer gets more convenience outlets for his money creating prospects for greater sales and use of appliances.

» The lower cost to the consumer does not alter the contractor's margin of profit . . . but makes lower bids possible and more jobs available.

» The quicker turnover of Porcelain knob and tube wiring material permits smaller stocks and investments.



» Porcelain permits greater flexibility in wiring layouts . . . easier to handle in old or new buildings, both rural and urban.

» It permits you to do a more elaborate wiring job for the same money . . . or an adequate one at lower cost.

On every call you make . . . talk and sell Porcelain Insulated Wiring! Send for the act Manual—an instruction booklet on insulated wiring which can be used in interviews with architects, home builders and home owners.

## **STANDARD ELECTRICAL PORCELAIN**

**MANUFACTURERS**

**201 N. WELLS ST., CHICAGO, ILL.**

Ceramic Specialties Company, East Liverpool, Ohio  
Illinois Electric Porcelain Company, MaComb, Illinois  
Knox Porcelain Corporation, Knoxville, Tennessee

Porcelain Products, Inc., Findlay, O; Parkersburg, W. Va.  
Specialty Porcelain Works, East Liverpool, Ohio  
Superior Porcelain Co., Parkersburg, West Virginia  
Universal Clay Products Co., Sandusky, Ohio

# EQUIPMENT

# News

## Vari-Pitch Speed Changer

The Vari-Pitch speed changer utilizes the principle of the Vari-Pitch sheave to provide a compact, economical and flexible unit in a great variety of industries. Consists of pair of shafts with two deep-grooved Vari-Pitch sheaves. Speed is adjusted through a worm and worm wheel operated either by a hand wheel, or by a pilot motor, controlled through a forward and reverse push button, which can be located within easy reach of the machine operator. A group of movable V-shaped plates mounted on a shaft permit the Texrope V-belt to ride higher or lower in the groove, thus producing a larger or smaller sheave diameter and resulting in a change of speeds. Belts easily changed. The speed changer can be operated at high speeds, permitting the use of a direct-connected motor. Seven sizes cover a range of from 1 to 33 h.p., with a speed range of 3.75 to 1, running approximately between 300 and 3,600. Texrope Division, Allis-Chalmers Manufacturing Co., Milwaukee, Wis.



ALLIS-CHALMERS SPEED CHANGER

## Baking Varnish

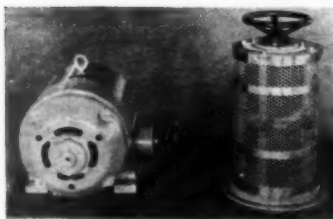
Synthetic black baking varnish, No. 154-B, is recommended for use on deep wound coils where hardening is difficult to obtain with a conventional type varnish. The finish provided by this grade is oil and water-proof. It will remain "open" after a short bake and will take another coat of varnish without danger of trapping solvents under first coat. On average type units intermediate coats only need be baked one to two hours. John C. Dolph Company, 166 Emmet St., Newark, N. J.



IDEAL COIL WINDING HEAD

## Coil Winding Head

This midget coil winding head is designed for making coils 4-in. by 1½-in. minimum up to 8½-in. by 6½-in. maximum. Can be mounted and used on face plate of any lathe having a 12-in. swing or larger, or on any other turning device. On smaller lathes, may be attached to outer end of headstock spindle. Open construction allows operator to wind all six coils in series, eliminating necessity of soldering and taping joints. Coils may be taped and tied together ready to be placed in armature or stator slots before removed from head. Ideal Commutator Dresser Co., 1041 Park Ave., Sycamore, Ill.



CROCKER-WHEELER MOTOR

## Adjustable-Speed A. C. Motor

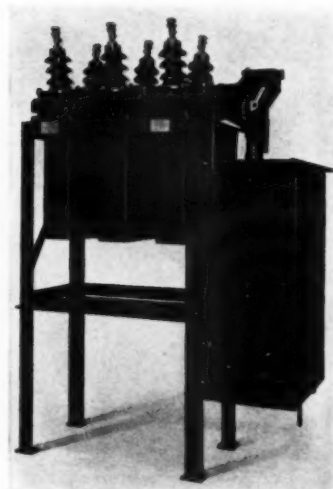
Polyspeed a.c. motors claiming operating characteristics similar to d.c. motors. Employ a 6-pole stator winding like an induction motor, a rotor similar to a d.c. armature, and a speed regulator. Provide: (1) fully continuous speed regulation, (2) shunt motor characteristics with speed practically independent of load, (3) con-

stant torque throughout the entire speed range, (4) simple operation, (5) across-the-line starting, (6) remote control.

Generated rotor voltage is regulated from bucking, or exactly opposite the stator voltage, up to field voltage. When reversed or non-bucking three-phase voltage is applied to the rotor brushes by the regulator, this aiding voltage causes the motor to run at higher than synchronous speeds. Speed regulator consists of two single-phase induction type voltage regulators, placed in one frame, with two rotors mounted on a common shaft. Present sizes are limited to 7½ h.p. and smaller.

Speed control from practically standstill to 1800 rpm. Below 600 rpm. a separate blower is used when the motor operates for other than short periods, because slow rotor speeds impair the motor's self-ventilation.

Recommended for spinning frames and other textile machinery, printing presses, machine tools and other applications where ease and stability of speed control are desirable. Crocker-Wheeler Electric Mfg. Co., Ampere, N. J.



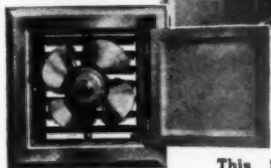
ALLIS-CHALMERS CIRCUIT BREAKER

## Oil Circuit Breaker

A new moderate capacity outdoor oil circuit breaker of quick clearing, non-oil-throwing design, known as type OZ-110. Special interrupting devices called "ruptors" are used to give quick clearing of short circuits, low arc energy, low pressure and minimum of oil deterioration. Other features are rigid cast steel top frames; silver contact surfaces; low-inertia, straight-line-motion type mechanisms; high speed operator; roomy, weather-proof control cabinet; one-piece, wet process porcelain bushings. Breaker furnished for 600 amperes at 15 kv, with an interrupting capacity rating of 100,000 kva. Arranged for pole or frame mounting. Allis-Chalmers Manufacturing Company, Condit Works, Boston, Mass.

## A KITCHEN *Necessity*

in  
EVERY  
HOME



This Signal Automatic Wall Box

Kitchen Vent Fan is easy to install, and adjustable to wall thickness . . . removes cooking odors, steam, smoke, and excess heat . . . operates quickly and quietly . . . available for A. C. or D. C. current: A. C. type is non-radio interfering . . . 10" quiet-type fan, cast aluminum frame. List price \$32.00. We will gladly send you complete information upon request.

**SIGNAL ELECTRIC MFG. CO.**  
Menominee, Michigan

Offices in all principal cities

**SIGNAL**

## PLAY SAFE! with **IDEAL** AC and DC Generator Voltage Regulators



Make IDEAL your source of supply for dependable Voltage Regulators. Quality at the right price—with a good profit for you!

Exclusive features and inexpensive construction enable IDEAL Regulators to give you high quality at a low price and to guarantee satisfactory service to your customers.

Write us for prices and discounts on all your Regulator jobs.

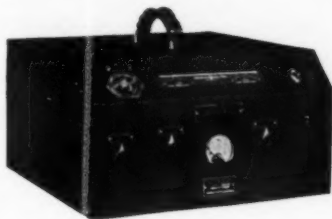
IDEAL now serves over 25,000 satisfied customers.

Write for Literature

**IDEAL COMMUTATOR DRESSER COMPANY**  
1041 Park Avenue Sycamore, Illinois

## Test Set

This portable bar-to-bar test set permits electrical resistance tests on d.c. armatures, to be made anywhere. Consist of a step-down transformer, a rectifier and a sensitive "light-beam" galvanometer, designed to give a full-scale deflection in the resistance range of 0.0001 to 35 ohms. Operated on any convenient 115 volt, 60 cycle outlet. Leads from four binding posts are attached to commutator, two furnishing current supply to resistance being tested and two being terminals of drop circuit, leading to galvanometer. General Electric Company, Schenectady, N. Y.



G.E. BAR-TO-BAR TEST SET

## Bathroom Heaters

Two new built-in heaters have been designed for the bathroom. "Bilt-In" model is 20 inches high and adapted for the average size home. The "Forty-Niner" (illustrated) is 49 inches of built-in heater that disperses radiant rays, traveling at the speed of light. Circulates warm air by natural means through the room. Wesix Electric Heater Company, 390 First Street, San Francisco, Calif.



WESIX BATHROOM HEATER

MCGILL LAMP GUARD



## Lamp Guard

An improvement in its protector "O" line of lamp guards, consists of a removable trap which may be attached to guards to give full protection to lamp bulb. Trap is attached to guard without use of tools and is readily removed to permit renewal or cleaning of lamps. No. 1429, without trap, is for brass shell sockets. No. 1432, without trap, for weatherproof sockets. Same with trap are No. 1429-T and No. 1432-T. Trap alone is No. 2932. McGill Manufacturing Company, Valparaiso, Ind.

## QUALITY means ECONOMY

- EASIER BENDING
- EASIER CUTTING
- EASIER THREADING
- EASIER WIRE PULLING

### "ELECTRICTUBE"

Electrical Metallic Tubing is coated on the outside with a substantial amount of zinc evenly deposited by electro-plating process to stand severe corrosive conditions. Interior surface is coated with an enamel especially developed by us, which is impervious to acid and insures a perfect roadway for pulling wires. Can be used with any standard light wall fittings.

### "GALVAKOTE"

Exterior surface and threads coated with zinc evenly deposited by electro-plating process in quantity to withstand more than four dips of Preco test in reposition copper sulphate solution. Interior furnished coated with the best quality black enamel.

### "ENAMELKOTE"

Coated inside and outside with high-grade black enamel, properly baked in modern ovens to insure adhesion to pipe wall, and sufficient flexibility to prevent flaking in bending.

### "HOTKOTE"

Exterior and interior surfaces evenly coated by the hot galvanize process and then covered inside and outside with a coat of transparent enamel.

### "HOTKOTE" NIPPLES

These rigid conduit nipples are also approved by the Underwriters' Laboratories and so labeled. All threads are protected with a special coating that is rust resisting.

**Underwriters' Laboratories**  
tested and approved.

Distributed everywhere by  
leading wholesalers.

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& COMPANY**  
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U. S. A.

MANUFACTURERS FOR MORE  
THAN A THIRD OF A CENTURY.

## MINERALLAC HANGER



Conduit  $\frac{3}{8}$ "— $2\frac{1}{2}$ "  
Cable to  $2\frac{1}{8}$ " (with Bushings)

## MINERALLAC JIFFY CLIP



Sizes from .250" O.D. Tubing  
to  $1\frac{1}{4}$ " conduit.

See your Jobber

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Theodore B. Dally  
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**MINERALLAC ELECTRIC CO.**  
25 N. Peoria St., CHICAGO

## YOU CAN'T GO WRONG— if you "RELY ON RELIANCE"



A complete line of thoroughly dependable quality time switches with innumerable exclusive features, giving you more time switch sales opportunities.

For 28 years the name of Reliance has stood for the best in the time switch field. A good line to handle because profits are not eaten up by expensive come-backs.

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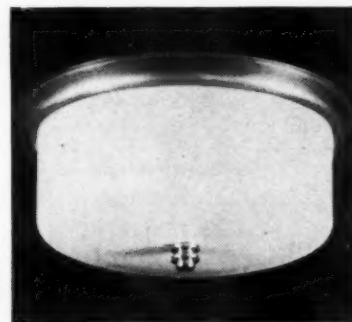
**RELIANCE AUTOMATIC LIGHTING CO.**  
1937 MEAD STREET RACINE, WIS.

## EQUIPMENT *News*

[FROM PAGE 91]

### Ceiling Mounted Fixture

A line of popular priced fixtures in three types designed for quick attachment to ceiling outlet boxes, with four sizes of glassware ranging from 8 to 14 inches in diameter. Construction features—will take two 60-watt lamps; running thread lock-up coupling also accommodates center pull chain; aluminum sprayed inner reflecting surface; heavy gage steel fitter, chrome finished. Chrome strips for glassware ornamentation or striped glassware available with each type. The Gleason Sales Company, 35 S. Desplains Street, Chicago, Ill.



GLEASON "EMPIRE" FIXTURE

## Transformers

— their kinds — fundamentals — uses —  
operation — maintenance

For the practical man this book deals concisely and plainly with all aspects of transformer construction and use, including underlying principles, applications, connection, testing, care, and economics.

Just published

## Transformer Principles and Practice

By J. B. GIBBS

Electrical Engineer, Westinghouse Elec. and Mfg. Co.

210 pages, illustrated, \$2.50

FROM this book the reader will get an introduction to the fundamentals of transformer performance and construction, also descriptions of many particular types of transformers, large and small, for various purposes. Usual methods of connecting transformers are described and diagrams given, also special applications of standard transformers, including phase transformation.

**Contents:** 1. Introduction. 2. Single-phase and Three-phase Transformers. 3. Coils and Cores. 4. Autotransformers. 5. Transformer Cooling. 6. Temperature Indicators. 7. Transformer Polarity. 8. Universal Transformer Connections. 9. Special Applications of Standard Transformers. 10. Parallel Operation of Transformers. 11. Phase Transformation. 12. Phase Transformation by Autotransformers. 13. Ratio Adjustment. 14. Transformer Oil. 15. Maintaining Oil Quality. 16. Mechanical Forces in Transformers. 17. Constant-current-regulating Transformers. 18. Instrument Transformers. 19. Transformer Insulation and Surge Protection. 20. Transformer Testing. 21. Care and Operation of Transformers. 22. New Transformers or Old? 23. Transformer Calculations.

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### Welder

The midget marvel a.c. welder has been designed for use in maintenance and repair as well as light construction work. A special transformer and control for a.c. arc welding. Current range from 30 to 140 amperes with 12 steps of current adjustment. Set is for use with coated electrodes from  $\frac{1}{8}$ -in. to  $\frac{5}{16}$ -in. diameter. The welder is portable, size 14 $\frac{1}{2}$ -in. high, 10 $\frac{1}{2}$ -in. wide and 17 $\frac{1}{2}$ -in. long, including handles. Accessories included with set, consist of welding lead with holder and current adjusting plug attached, ground lead with handy "C" clamp, helmet, wire brush, electrodes and primary lead. Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa.



WESTINGHOUSE MIDGET WELDER

## OK ILSCO SOLDERLESS CONNECTOR

### No Costly Castings or Forgings

ILSCO construction does not require the use of castings or forgings. That's one reason ILSCO Solderless Connectors are so economical to buy . . . their utter simplicity makes them equally economical to use. Other ILSCO features:

NO Set-screw contact  
NO flattening or separating of stranded wires.  
NO limitation to one size wire.  
NO special tools required  
NO shearing effect whatsoever.



NO need for you to search any longer for the PERFECT Solderless Connector . . . WE HAVE IT! Six Sizes Take Care of All Wires from No. 14 to 1,000,000 C.M.

FREE—A large display board bearing mounted samples of ILSCO lugs. Address Dept. EC

ILSCO COPPER TUBE & PRODUCTS, INC.  
5629 Madison Road, Cincinnati, Ohio

## VICTOR "FORCE AIR" EXHAUST FANS

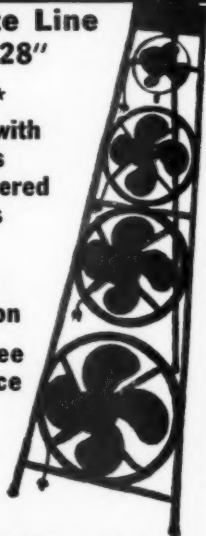
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6" to 28"

Equipped with  
Victor's  
Super-Powered  
Motors

Rugged  
Construction  
Trouble-free  
performance

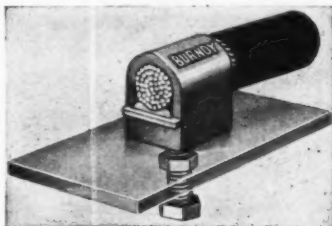
Special  
Low  
Prices!

Ask Your Jobber or Write for  
Catalog to  
VICTOR ELECTRIC PRODUCTS, INC.  
801 Reading Road Cincinnati, Ohio



### Clamp Connector

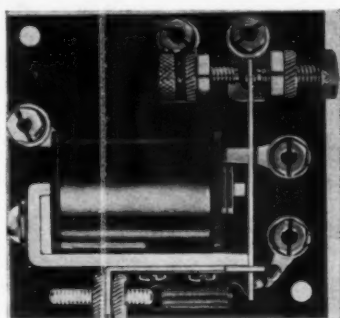
A clamp connector especially designed for terminating cables to copper bars extending from each side of current transformers. Type KPF clamp consists of cast copper body through the bottom section of which a hole is tapped. A 1/2-in. bolt passes through hole in copper bar and into tapped body hole where it forces pressure bar against cable. Accommodates a range of cables and can be pivoted upon bolt to permit cable tap-off at any angle from bar. Burndy Engineering Co., Inc., 459 East 133d St., New York.



BURNDY CONNECTOR

### Sensitive Relay

A new a.c. sensitive relay is available with single pole, double throw contacts. High degree of sensitivity, good contact torque at pull-up and crisp constant drop-out is made possible by use of nickel alloy in magnetic circuit. Coils available for currents from 1.5 to 450 M.A. Knurled nuts facilitate adjustments of silver contacts and armature spring tension. Ward Leonard Electric Co., Mount Vernon, N. Y.



WARD LEONARD RELAY

### CUTLER-HAMMER STARTER



### Manual Starter

A compact a.c. across-the-line starter has been developed for use on polyphase squirrel cage motors, and innumerable applications, including fans, pumps, textile machinery, machine tools. Starter, measuring 4 1/2-in. by 8-in. and known as NEMA

IT CUTS COSTS!!!  
IT'S LOW PRICED!!!  
IT STANDS THE "GAFF!!!"



## THE MILWAUKEE HAMMER-DRILL

A really handy, hard-working Tool that soon pays for itself



Users say "Here's the tool I've dreamed about"

### It Hammers

Up to 1 1/4" diameter holes in concrete when using a hollow-drill. Will drill 1/2" hole 4' deep in one minute. Use it for scaling, channeling, grooving, vibrating, bush-hammering, caulking, etc. Equipped with rubber shock absorbers, absolutely eliminating all shock to motor.

### It Drills

Up to 5/16" diameter holes in steel, 1 1/4" in wood. Hammer attachment can be removed easily if user desires to drill holes through wood or steel. Every shaft mounted on precision oil-seal, dirt-proof ball bearings. Helical cut alloy steel gears, 1/4" heavy duty Jacobs key chuck.

### It Grinds

Sharpen your tools right on the job by using emery wheel with arbor to fit into chuck of electric drill.

★This tool will help you get that next job you bid on. It will cut your time and labor costs in half and enable you to take more jobs at a larger profit per job. Full ball bearing construction throughout. Furnished complete with STURDY, WOODEN CARRYING CASE, 1/2" Jacobs chuck and key, special taper tool chuck, one 1/2" star drill, 12-ft. 3-wire heavy duty rubber cable, and tool retaining spring. Universal motor for D.C. or A.C., 25, 48, or 60 cycles. Furnished with 32, 118, 150, 220, or 250 volt motor as specified. Used and recommended by contractors all over the country. For further information, write:

MILWAUKEE ELECTRIC  
TOOL CORPORATION  
106-109 N. Water St.  
MILWAUKEE WISCONSIN

## SHERMAN RIGID GROUND FITTINGS . . .

- \*Reliable
- \*Dependable



**SOLDER  
AND  
SOLDERLESS  
GF3**

- Of heavy malleable iron—rustproofed by a special process to insure long, dependable service. Screws have slotted hexagon heads and have lock washers. GF3 expressly designed for No. 4 bare copper wire. Will take No. 10 B & S. Slotted clamp may be reversed for use with guard rod. Send for Bulletin No. 12.

**H. B. SHERMAN  
MFG. CO.**  
Battle Creek, Mich.



## FEDERAL PORCELAIN BUSHINGS

All bushings are made of one piece of the best grade of vitrified porcelain. Clamping rings are made of metal, threaded to fit threads on the porcelain. Bushings can be furnished in color.

Other Federal specialties available are:

Porcelain Clip Type Bushing  
Spring Clamp Bushing  
Pipe Thread Bushings  
Porcelain Sockets

Write for catalog page 914 and 915 for details.

**FEDERAL ELECTRIC CO.**  
8726 South State Street  
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**It  
PAYS  
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SERVICE**  
Dealers Wholesale Catalog  
Co-op Electric Supply Co.

**CO-OP ELECTRIC SUPPLY CO.**  
812 W. Jackson Blvd., Chicago, Ill.



[FROM PAGE 93]

size 0, is rated up to 2 hp., 550-volts. New features are "pushbutton" operation; positive quick make and break "twin-break" mechanism; silver-to-silver contacts; three and four pole construction; eutectic thermal overload protection, free tripping type. Cutler-Hammer, Inc., Milwaukee, Wis.

## Instrument

New model "DM" Megohmmeter may be used also as a portable a.c. and d.c. voltmeter where formerly it was only suitable for d.c. measurements. It has a range of 600 volts. This model is based upon the voltmeter method of insulation resistance measurements. Measuring system is built into a metal housing, which is mounted over the generator. Housing is mounted with shock absorbing springs. A test key is provided for checking generator voltage. Herman H. Sticht & Co., 27 Park Place, New York City.



STICHT "DM" MEGOHMMER

## Interchangeable Switches

A new line of residence type interchangeable switches for the small home market. It may be combined with any of the switch, outlet and pilot combinations, of the "IL" line. Features completely enclosed bakelite body, self-aligning bronze contacts, arc snuffing barrier, bakelite handle, positive kick-off. Ratings 10-amp., 125-volts; 5 amp., 250-volts. The Bryant Electric Co., Bridgeport, Conn.



BRYANT INTERCHANGEABLE SWITCH

## • SELLING PROFIT • INSTALLATION FEE

Get BOTH by recommending this ultra-modern electrical convenience to home owners and builders.



BATH

KITCHEN

LAUNDRY

The

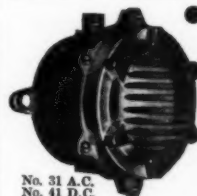
## SAVUTIME WATER HEATER CONTROL

Every home owner and builder is an easy prospect for Savutime Water Heater Control. Installation is extremely simple and means an extra profit for contractors.

With Savutime the gas water heater is lighted instantly, merely by pressing a button in bathroom, kitchen or laundry. It is turned off automatically by a thermostat if the user should fail to shut it off. Sure, fool-proof and safe, Savutime requires no skilled attention or maintenance. Low voltage circuit operates from bell transformer.

Write at once for details and attractive sales proposition

**Savutime Devices**  
Incorporated  
88 Manhattan St.  
Rochester, N. Y.



No. 31 A.C.  
No. 41 D.C.

## • FEDERAL High Power

Weatherproof and Watertight Vibratory Horn for Industrial Use

These special horns are available for operation on 110 volt alternating or direct current only. Fast in coding. Constructed of non-corrosive materials. Have twice the sound volume of ordinary vibratory horns. Ask for catalog page 104.

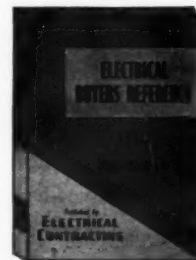


No. 30

## • New FEDERAL No. 30 Horn with Directional Projector

For large plants and yards everywhere. Projects sounds in different directions. Volt 6 to 250 A.C. only—Type 40 for D.C. Built to last a lifetime. Ask for Bulletin No. 57. Federal Electric Co. 8726 South State St. Chicago, Illinois

You'll find the answer to thousands of questions about electrical products in



Electrical Contracting, April 1938

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\* See 1937-1938 Buyers' Reference number of Electrical Contracting for additional information on these companies and their products.

## ROME-CABLE BUILDING WIRE

### THOROUGHBREDS

Thoroughbreds go around the track the fastest. Inherent quality gives them an edge over the "also-rans". "Rome-Cable" cable and wire sells fast because it is "thoroughbred" wire . . . because inherent quality gives it an edge over ordinary wire. "Rome-Cable" quality gives better performance . . . satisfies users . . . makes it easier for you to satisfy your customers . . . and, most important, helps you to build bigger profits through repeat orders.

### ROME CABLE QUALITY

Code, Intermediate 30% and Superaging Approved by the Underwriters' Laboratories, Inc. N.E.C.S. Flame & Moisture Resistant

\*Slack Finish for Quick and Easy Pulling • Long Aging Rubber Uniformly Small Diameters • Clean — Easy Stripping • Eight Clear Distinct Colors



### PRODUCTS

Hot rolled rods, bare and tinned copper wire, bare and tinned strand, U.R.C. weatherproof wire, cotton, paper and asbestos magnet wire, rubber insulated wires and cords, lead covered cables.

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New York Chicago Philadelphia  
Pittsburgh Richmond  
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## Insist on CERTIFIED RATINGS Install AUTOVENT Ventilation

"The Complete Line"



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### PROPELLER FAN JOBS

Bring RICH PROFITS to every contractor!

\*Every office and plant requires sufficient propeller fans to provide adequate ventilation. The "BW" or (Bucket Wheel) type pictured above is a popular, slow speed operating unit, particularly designed for efficiency and economy. Check up on manufacturers in your vicinity—learn their ventilation problems—start cashing in on these PROFITABLE PROPELLER FAN JOBS at once! Certified ratings. Performance data, specifications, prices, profits on request! Bulletin No. 292.

**AUTOVENT FAN & BLOWER CO.**  
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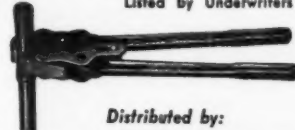
## A REALLY SIMPLE METHOD . . . Saves Time and Money



• B-M Connectors and Couplings make dependable installations quickly and easily. That is why they are so popular with Contractors who handle a volume of work. Just two squeezes on the handles of the B-M Indenter and the B-M Connector or Coupling is securely fastened to the Electric Metal Tubing—no lost time with this really simple method.

• You can save more than enough on the cost of 100 B-M Fittings to pay for a B-M No. 405 Indenter, and you pocket the savings. Our tools and method of fastening the fittings to the tubing are patented and we therefore, limit the license of our tools under these patents to the installation of our fittings only. Let us give you further details.

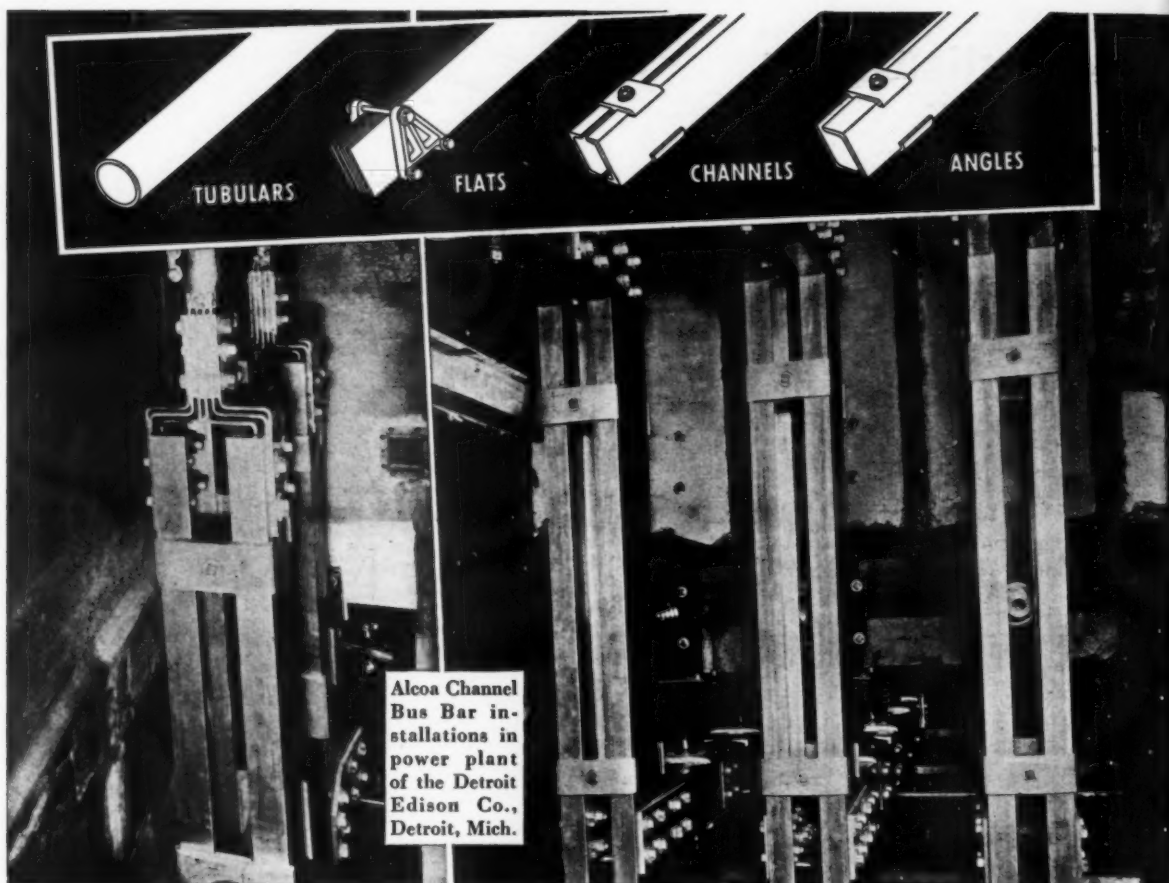
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## *Alcoa Aluminum Bus Bar*

**FOR INSIDE OR OUTDOOR WORK,  
FOR LIGHT LOADS OR HEAVY DUTY**

**N**O MATTER WHAT the requirements, you'll find an Alcoa Aluminum Bus Bar suited to the job. Inexpensive, standard fittings are available.

The light weight of Aluminum simplifies installation work. It also results in a minimum of strain being placed on supporting structures, and framework can be lighter. Savings are often possible, therefore, on erec-

tion and material costs. Because Aluminum is highly resistant to corrosion, long life is assured even under adverse conditions.

Alcoa Aluminum Bus Bars are assembled in the usual manner, by clamping, bolting or welding. Our engineers are "at your service" to help solve bus bar problems. ALUMINUM COMPANY OF AMERICA, 2197 Gulf Building, Pittsburgh, Pennsylvania.



# ALCOA · ALUMINUM





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# Private Interior Telephone Systems



**MEAN "PLUS" BUSINESS FOR YOU**

● Right now you are serving scores of concerns whose efficiency can be stepped way up with interior telephone facilities. By telling them about the Automatic Electric line, you not only get in on some profitable "plus" business, but you perform a genuine service for them as well.

Your market is as broad as business itself. All offices, shops, factories and residences are good prospects. And right now is an especially good time to push private telephones because business has become definitely communication conscious.

Automatic Electric makes private telephone systems to fit every need. Shown below are four of the many types available. Our field representative will gladly supply you with literature, prices and discounts, as well as work with you on specific jobs. Call on him for help.

## INTERCOMS

Common talking, selective-ringing systems in capacities of two to eleven stations. Beautifully designed, and durably constructed for long faithful service.

## SERV-U-FONES

Attractively priced common-talking systems in capacities of two to ten stations. Conveniently packaged, simple to install. Dry cell operated.



## AUTO-COMS

Deluxe intercom. systems, providing selective talking and selective signaling service for a maximum of ten stations, and up to five connections at one time. No automatic switchboard needed.

## P-A-X's

Private Automatic Exchange systems, available in all capacities. Use standard automatic telephones and provide for a variety of special communication services.

**AUTOMATIC  ELECTRIC**

**PRIVATE INTERIOR TELEPHONE SYSTEMS**

Distributed by: **AMERICAN AUTOMATIC ELECTRIC SALES COMPANY**, 1033 West Van Buren Street, Chicago, Illinois  
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*Electrical Contracting, May 1938*



ORANGEBURG

# NOCRETE

FOR USE UNDERGROUND

Orangeburg now offers a new non-metallic conduit combining the various characteristics required for use underground without concrete encasement; suggested for house connections, laterals and extensions, single, double and even triple duct runs; parkway, lighting and suburban services; signal systems; substation yards and industrial or institutional grounds.

Conduit for installation underground without concrete encasement must have two prime characteristics: (A) mechanical strength; (B) ability to endure permanently.

Because of its mechanical strength, steel conduit (or iron pipe) has been the most widely used for such type of installation. While there is no disputing the adequacy of its *initial* strength, corrosive agencies soon minimize or nullify the original strength.

In **NOCRETE** Conduit, Orangeburg offers a conduit meeting not only the requirements of strength and permanency but, in addition, two additional and most important advantages—cable protection and dual economy; savings to you in "material costs" and savings to you in "installation costs". While other

non-metallic conduits offer some of the desired qualities of a conduit for installation without concrete encasement, none offers the combined qualities now available in Orangeburg **NOCRETE** Conduit.

As you know, Orangeburg have been specialists in "underground" and are the largest and oldest manufacturers of underground conduit. For over 45 years "Standard" Orangeburg has been used by light and power companies for underground distribution systems (encased in concrete). Orangeburg **NOCRETE** now offers the same superlative type of underground conduit construction for the smaller installations where concrete encasement would not be required.



## ORANGEBURG

## Savings IN "MATERIAL COSTS"

Orangeburg **NOCRETE** Conduit is about *half the cost* of metal pipe and less than non-metallic conduits of any comparable quality! Ask the G.E. Supply Corp. or the Graybar Electric man for prices.

## Savings IN "INSTALLATION COSTS"

It "handles easy": light in weight, in handy 5 or 8 foot lengths (in various sizes), this super-sturdy duct will surprise you by its adaptability.

It assembles with a minimum of effort and time. The joint is of the taper sleeve type (Harrington Joint), with a coupling included (free) for every length. Precision machining of the joint enables a water-tight connection by easy drive using a block and mallet.

It is readily cut by ordinary woodsaw. It can be tooled to exact fit with reasonably priced, portable tooling machine, hand operated, or trimmed and fitted with ordinary wood working tools.

Extra couplings, all types of fittings, bends, ells, adapters, reducers, etc., are available at equally low prices.

Recent installation made by the Public Service Gas & Electric Co. of New Jersey.



*The new Dual Economy*

# CONDUIT

## WITHOUT CONCRETE ENCASEMENT

## Service at the turn of your phone dial

Two outstanding national distributors are exclusive sales agents for Orangeburg products, with sales offices near you and warehouses for prompt delivery within your district:

The Graybar Electric Co.

The General Electric Supply Corp.

Ask their representative for further information.

### Customer Satisfaction:

Your customers will appreciate the permanent, satisfactory service of Orangeburg **NOCRETE**.

For instance, tree roots, termites or vegetable growths will not enter or affect this unique material.

Its cable protective qualities, you know.

Trouble-free service is assured.

Combine the best underground installation with *dual economy* savings.

### THE FIBRE CONDUIT COMPANY

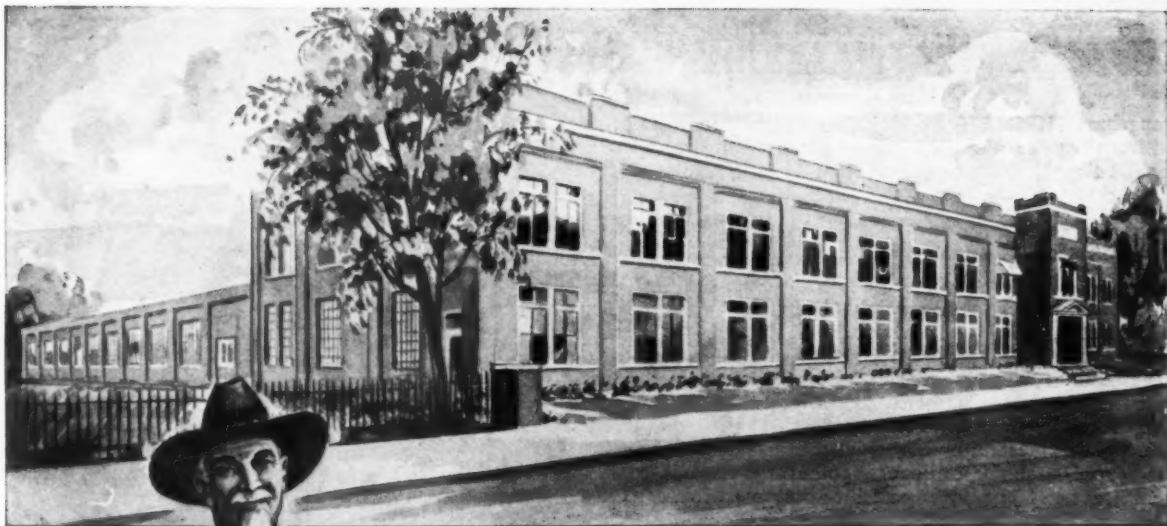
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Factory: Orangeburg, N. Y.



Sales Agent—Distributors:

The Graybar Electric Co. General Electric Supply Corp.

# ORANGEBURG



*It is a*  
**WADSWORTH**  
*Tradition*

THIRTY YEARS seems like a long time — still — more than 30 years ago Wadsworth started to make switches. Through these years Wadsworth blazed a trail on which are numerous sign posts pointing to the many common sense engineering principles developed and pioneered by the Wadsworth Organization.

The HISTORY of Electrical Switch Making is still unwritten — when the facts are assembled Wadsworth will share a place of honor and distinction for its generous contributions and recognized accomplishments.

One of the OLDEST and LARGEST Independent Switch Manufacturers — Wadsworth upholds a spotless reputation for fair dealing. Then, too, the fine quality of its products has been rigidly maintained. Although constantly searching for new and better methods — Wadsworth never experiments at the public's expense. Electrical Contractors know this — and so do Electrical Wholesalers. Their confidence and continued patronage is greatly acknowledged.

**THE WADSWORTH ELECTRIC MANUFACTURING CO. INC.**  
**COVINGTON, KENTUCKY**